

Medical Research Council of Canada

A Legacy Of Excellence 160 years MP



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A Legacy of Excellence

1960 - 2000

years



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Holland Cross

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Message from the President

OVER THE PAST 40 YEARS, WOMEN AND MEN STRIVING TO REACH THE PINNACLE OF EXCELLENCE IN HEALTH RESEARCH HAVE BEEN SUPPORTED IN THEIR EFFORTS BY THE MEDICAL RESEARCH COUNCIL OF CANADA. INDEED, THE MRC HAS BEEN AN INTEGRAL PART OF MY OWN CAREER. THE RESEARCH ADVANCES I HAVE MADE, BEGINNING WITH THE DISCOVERY OF PROLACTIN, WOULD NOT HAVE BEEN POSSIBLE WITHOUT ITS SUPPORT. THANKS TO THAT SUPPORT, MANY THOUSANDS OF COUPLES TODAY KNOW THE JOYS OF PARENTHOOD WHO OTHERWISE MAY NOT HAVE — JUST ONE OF THE MANY EXAMPLES OF THE DIRECT BENEFICIAL IMPACT MEDICAL RESEARCH HAS HAD ON THE LIVES OF INDIVIDUALS.



Henry Prosser, M.D.

Over the past decade, I have had the opportunity, and the privilege, to return the favour. I have been able to assist in ensuring that researchers continue to receive the same support I was so fortunate to have, and to head an organization which every day is devoted to making a difference in the lives of Canadians.

To succeed, a research enterprise must always be looking to the future — to the next discovery, but even more importantly, to the next generation of health researchers. Without the initial

harnessing of talent, there would be no health research enterprise in Canada. MRC has been proud of the central role it has played in harnessing the talent of Canada's health researchers. Today, many deans of research at Canada's medical schools and heads of major departments in the health sciences are MRC alumni, doing their part in turn to continue the cycle of innovation.

This publication is not about an organization. It is about people — the people whose work has given Canada a well-deserved reputation for excellence in health research throughout the world, who make us confident in our health care system, and whose efforts the MRC has supported over its lifetime.

The first two chapters provide a historical overview of the past 40 years. The next two chapters examine some of the innovations that have characterized MRC's work in the 1990s. Finally, we look to the future — to the health researchers whose work is making a difference and to the new world of the Canadian Institutes of Health Research (CIHR).

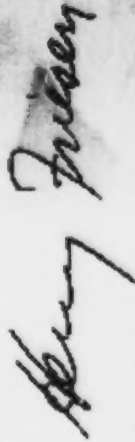
Today, the CIHR is well underway. But our job is not done. As we look ahead, I encourage all members of the health research community to continue to work to achieve the next goal, that of ensuring that the federal government invests one per cent of all health care costs in health research. Through CIHR, through the Canada Research Chairs, and through leveraged funding from partners, we should continue to strive towards an annual investment of \$1 billion for health research by the federal government. This total will position Canada as an internationally competitive funder, allowing us to excel in the global arena.

It is not often that an organization asks to be disbanded. But that is exactly what the Council of the MRC requested of the federal government. We asked, because we knew that it was time to implement a new vision of health research for the 21st century, and we knew that the best way to do that was through thematically linked institutes creating virtual networks of researchers coast to coast — the CIHR structure.

But as we leave, it is important that we pause to celebrate the solid legacy of excellence in health research that was the hallmark of the MRC throughout its existence. It is that legacy we celebrate in this publication.

THE MEDICAL RESEARCH COUNCIL OF CANADA

That legacy would not be possible without the people responsible for MRC's successes — my predecessors on the Council; the men and women who have served the MRC over the years; the many hundreds of researchers who have spent time from their own work to act as MRC reviewers, and members of standing committees; and last, but by no means least, the dedicated staff of MRC who have worked for its success for so many years. I thank them all.



Henry Friesen
President, Medical Research Council of Canada
1991 - 2000



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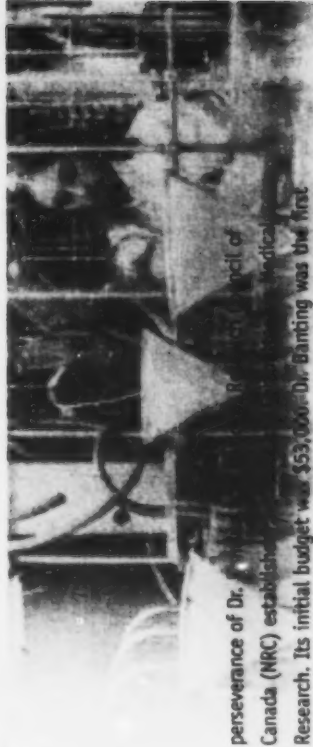
Chapter I: A Long and Distinguished History

WHEN FREDERICK BANTING, CHARLES BEST, J.J.R. MACLEOD, AND J.B. COLLIP PRODUCED THE RESEARCH THAT LED TO THE DISCOVERY OF INSULIN IN 1921, THEIR ACHIEVEMENT CREATED NEW HOPE FOR PEOPLE WITH DIABETES. BUT THE REVERBERATIONS OF THEIR DISCOVERY EXTENDED FAR BEYOND THE CONFINES OF ONE DISEASE. THAT THESE YOUNG, RELATIVELY INEXPERIENCED RESEARCHERS COULD BREAK OPEN THIS MAJOR RESEARCH PROBLEM, PROVIDING HOPE AND LIFE FOR SUFFERERS OF THIS LETHAL DISEASE AFFECTING MILLIONS, CAUGHT THE IMAGINATION OF PEOPLE AROUND THE WORLD, AND DEMONSTRATED THAT CANADA HAD WORLD-CLASS RESEARCHERS WHOSE EFFORTS DESERVED TO BE SUPPORTED. THEIR DISCOVERY LED, INDIRECTLY, TO THE CREATION OF THE MEDICAL RESEARCH COUNCIL OF CANADA.

Did you know...

In 1921, in the time of Banting and Best, 1,100 women died in childbirth in Canada. In 1994, only 10 women died in childbirth across the entire country. Medical research has changed maternity from a life-threatening into a life-enhancing experience.

These eminent scientists believed that government should have a role in funding medical research in Canada, just as it funded other types of scientific research. In 1936, thanks to the



perseverance of Dr. Frederick Banting and the Medical Research Council of Canada (MRC) established the Medical Research Council of Canada (MRC) Research. Its initial budget was \$53,000. Dr. Banting was the first chair of this committee, whose membership was largely composed of representatives of the nation's medical schools. One of its first decisions was to not establish central laboratories for medical research, but rather to support research in the universities. To that point, outside of the University of Toronto and McGill University, faculty with an interest in research had little or no institutional support. This decision has had a central influence on the subsequent development of medical research in Canada.

In 1946, the Associate Committee was replaced by the NRC Division of Medical Research. The discoverers of insulin continued to play a central role in promoting medical research in Canada, as J.B. Collip headed the division. Like its predecessor, the Division of Medical Research had no laboratories of its own, and focused its activities on supporting extramural research in universities. The Division's initial budget of \$200,000 had grown to some \$900,000 by 1957, and research supported by the Division resulted in 950 publications in the period 1956-59 alone.



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THE MEDICAL RESEARCH COUNCIL OF CANADA

A LEGACY OF EXCELLENCE

Early Canadian Research Achievements

- In the late 1930s, **W.E. Brown**, of the University of Toronto, demonstrated the value of bromide and ethyl chloride as anaesthetics.
- During the 1930s and 1940s, **Wilder Penfield** developed a brain-mapping technique that paved the way for modern neurology and the treatment of diseases affecting the central nervous system. Penfield later developed a surgical method for treating epilepsy that became known around the world as the "Montreal method."
- In the early 1950s, the **Connaught Laboratories** at the University of Toronto played an essential role in developing a polio vaccine to combat a poliomyelitis epidemic that threatened thousands of Canadians.

"The most commonly expressed desires were for some form of senior research appointment tenable in the universities, for some assurance of continuity of support for research, and greater freedom in the administration of grants."

Results of a survey of research programs and needs of medical schools in Canada conducted by Dr. Frederick Banting and Dr. Chester B. Stewart (1946), reported in *Proceedings of the First Meeting, Medical Research Council*, March 8-10, 1961.

In 1960, the Medical Research Council was established as an autonomous body within the administrative framework of the NRC. The new body had an initial budget of \$2.3 million, its own administrative structure, and the freedom to develop its own policies. The new MRC focused its initial efforts on strengthening medical research in universities through a series of programs designed to aid researchers, from undergraduate students to the most senior researchers. By providing ongoing support in this manner, MRC helped to build local research capacity while underscoring the importance of having faculty members devoted full-time to research and of providing training opportunities, not only in clinical practice but also in research. In 1963, MRC established a scholarship program to provide talented young researchers with the means to conduct independent research after completing their formal training.

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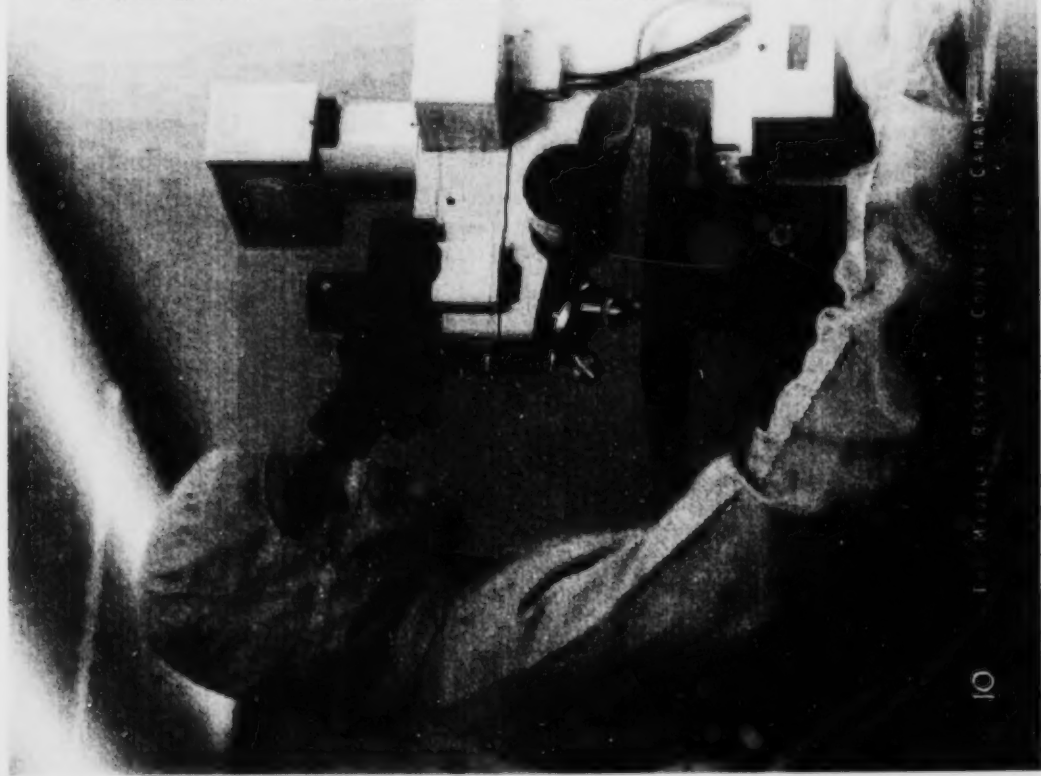
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The decade between 1960 and 1970 was a period of exponential growth for medical research in Canada. The MRC budget increased 15-fold. The number of schools of medicine grew from 12 to 16, and MRC began accepting applications for research funding from Canada's 10 schools of dentistry, eight schools of pharmacy, and school of veterinary medicine.

In 1969, Parliament passed the *Medical Research Council of Canada Act*, which formally created the MRC as an autonomous crown corporation, reporting to Parliament through the Minister of National Health and Welfare, and ending MRC's 32-year relationship with the NRC. Its mandate was "to promote, assist, and undertake basic, applied and clinical research in Canada in the health sciences; and advise the Minister of Health in respect of matters relating to such research."

Over the subsequent 30 years, under the guidance of its five presidents and two acting presidents, the MRC has continued to expand the boundaries of health research.

The 1970s: A period of growth

In its first year of existence as a crown corporation, the MRC received \$27.2 million, which funded some 1,200 researchers. By the mid 1970s, its budget had increased to \$47 million and the number of supported researchers to more than 1,500.

MRC Presidents



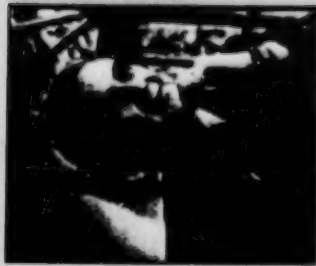
1960-65: Ray Faguhanson, M.D.,
M.B., F.R.C.P.(C), F.R.C.P., M.D.(Hon.),
D.Sc.(Hon), F.A.C.P., F.R.S.C.



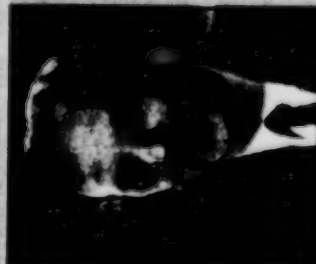
1965-77: G. Malcolm Brown, M.D.,
C.M., D.Phil., LL.D., D.Sc., M.D.(Hon),
F.R.S.C., F.R.C.P., F.R.C.P.(C), F.A.C.P.



1977-78: Jean de Margerie, M.D.,
D.Phil., F.R.C.S.(C), F.A.C.S. (acting)



1978-81: René Simard, M.D., D.Sc.,
F.R.C.P.(C)



1981-91: Pierre Bois, M.D., Ph.D.,
F.R.C.P.(C), F.R.S.C.



1991: David Huxtable, M.D.,
F.R.C.P.(C) (acting)



1991-2000: Henry Freeman, O.C.,
M.D., F.R.C.P.(C), F.R.S.C.

The 1960s and 1970s

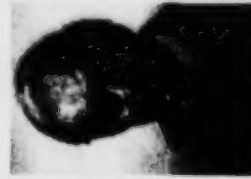
- **Bruce Chown**, a pathologist at the Winnipeg Children's



Hospital, devoted his career to understanding and treating erythroblastosis fetalis, or Rh disease, caused by a fetal blood factor commonly known as the Rh factor. He subsequently set up the Rh Laboratory to manufacture Rh immune serum under license in 1968.

Thanks to his work, the vast majority of potential Rh disease in Canada and around the world has been eliminated.

- In 1960, at the Hospital for Sick Children in Toronto,



orthopaedic surgeon **Robert Salter** developed the "Salter Operation" for hip dislocation in children. The procedure is still used worldwide. In the 1970s, Dr. Salter recognized the therapeutic effectiveness of continuous passive motion (CPM) to the repair of cartilage injuries, a finding that has been

translated into clinical application throughout the world. By 1998, CPM had helped more than five million people, and offers potential for helping millions more.

- The survival rate of newborns, especially premature infants, suffering from acute respiratory distress rose from 25 per cent to 75 per cent at Winnipeg's Children's Hospital, after **Victor Chernick**, of the University of Manitoba, decided to approach the problem in a new way. Rather than applying increased air pressure to the baby's lungs and airways, he surrounded the baby's chest wall with a constant negative pressure, assisting the air flow in and out of the lungs while avoiding the dangers of an indwelling tube in the infant's windpipe or of applying increased pressure to the lung tissues.

Important new initiatives in the 1970s included support for clinical trials in perinatology and the establishment of MRC Groups and program grants to promote multidisciplinary research. In 1971, MRC established a clinical trials grant committee to support research into the potential benefits and drawbacks of new diagnostic and treatment protocols.

A Commitment to Ethics

Throughout its existence, the MRC has broken new ground in many different areas, including taking a leadership role in the area of ethics.

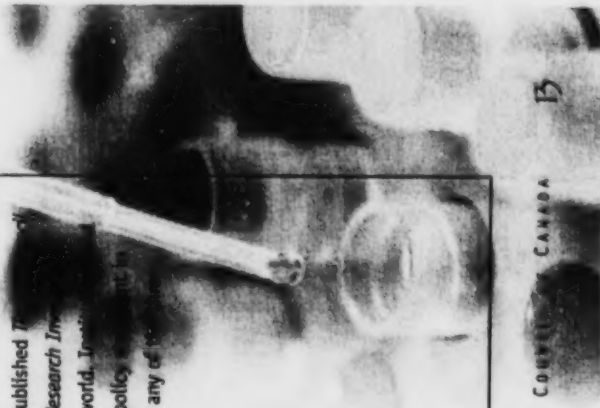
In 1962, MRC asked the National Research Council to join it in reviewing the use of animals in research. This led to the establishment of the Canadian Council on Animal Care in 1968.

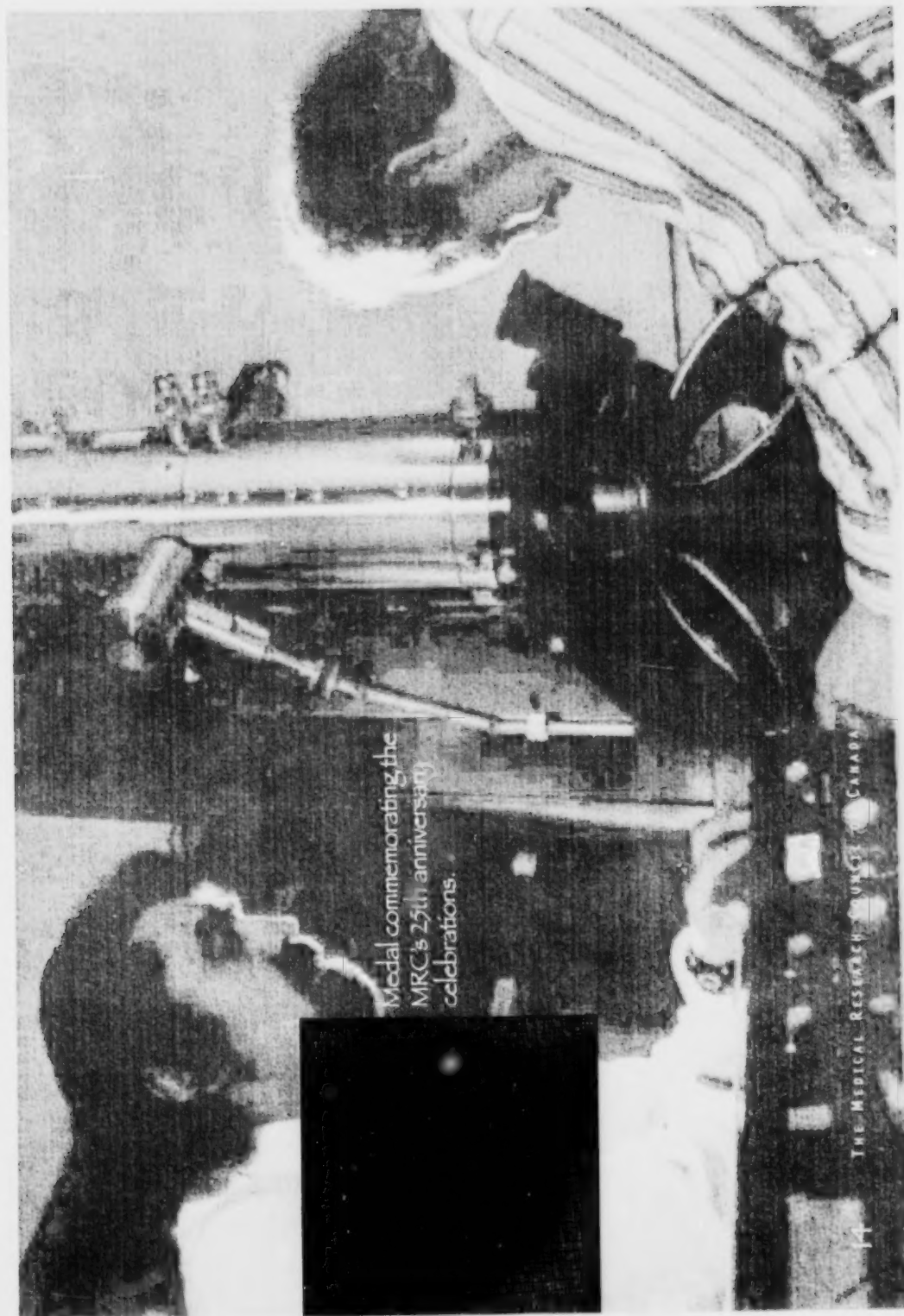
In 1976, the MRC established a Working Group on Human Experimentation. Based on its work, MRC subsequently developed and published guidelines on the ethics of research involving human subjects. It also provided leadership in developing a Canadian vision of the ethics of genetic engineering.

In 1989, MRC spearheaded the foundation of the National Council on Ethics in Human Research (NCEHR), to which it provides funding, along with the other granting councils, Health Canada, and the Royal College of Physicians and Surgeons. NCEHR carries out education and awareness activities to help Research Ethics Boards to implement ethics policies.

In the 1990s, MRC undertook a review of existing guidelines on ethics, in consultation with the Social Sciences and Humanities Research Council of Canada (SSHRC) and the Natural Sciences and Engineering Research Council of Canada (NSERC). A task force composed of representatives of all three councils consulted with researchers across Canada to develop a common approach to ethics across traditional disciplinary boundaries.

In September 1998, the three councils published *The Policy Statement on Ethical Conduct for Research Involving Humans*, the first such initiative in the world. In order to receive funding or support from any of the federal granting councils,





Medal commemorating the
MRC's 25th anniversary
celebrations.

THE MEDICAL RESEARCH COUNCIL OF CANADA

The 1980s: Broadening the mandate

The 1980s saw the development of MRC's first five-year plan, which provided a new focus for MRC's work. By the end of the 1980s, the Council's budget had nearly tripled, from \$70 million to \$202 million. New programs were being developed, including the MRC Scientist program and a new biotechnology training program. This last was seen as holding great promise for improving the diagnosis and treatment of disease.

The late 1980s was also a period of growing awareness of the importance of science and technology to a healthy economy. Governments began to develop new ways to work with the private sector and industry. The University-Industry Program, developed in 1987, provided a means of linking university research with industry, increasing the likelihood that the economic benefits of research funding would be realized in Canada.

The third theme that characterized the 1980s was a trend toward greater support of multidisciplinary research. Program grants began to support an increasing number of research teams, as well as individual researchers.

Research achievements

- **Albert Aggeler** discovered a new way of generating new nerve cells in animals. In 1989, he was awarded the National General Science Award. This breakthrough has a huge impact on efforts to prevent permanent disability following brain injury, stroke, and neuro-degenerative disease.
- University of Toronto researcher **Tak Mak** discovered T-cell receptors in 1983, and went on to clone and sequence the gene for these receptors. He describes T-cells as "biodefectives," cruising through blood and tissues looking for viruses to destroy. The receptors tell them when they have hit their viral target.
- Another University of Toronto researcher, **Lap-Chee Tsui**, discovered the gene that causes cystic fibrosis in 1989. His work is now the basis of international research efforts to find a cure for this disease, which affects one in every 2,500 children born in Canada.
- As the founder of the McConnell Brain Imaging Centre in the 1980s, **Brenda Milner** has focused on reducing damage to language skills caused by brain surgery.

The 1990s: New challenges, new responses

The 1990s brought new challenges and new opportunities.

A strategic planning exercise in 1991, involving extensive consultations and workshops, brought together more than 4,000 members of the health research community across the country. The Council's resulting 1993 strategic plan, *Investing in Canada's Health*, featured two foci for MRC:

- First, funding support would be extended to include the full range of health research, including psycho-social factors related to health, population health, health services and health care delivery. In effect, MRC set out to become a broad health research council.
- Second, alliances and partnerships with a variety of organizations, including the private sector, would become a key strategy for attracting urgently needed new resources to support research across the country.

These developments are discussed in greater detail in later chapters.



MRC's leadership and growth throughout the 1980s was recognized in 1985 by Winnipeg's St. Boniface General Hospital Research Foundation, which bestowed on the Council its International Award for significant contributions to the development and support of research in medicine, pharmacy and dentistry across the country over its 25 years of existence.

Into the 1990s

- **Phillipe Gros**, of McGill University, and **Emil Skamene**, of Montreal General Hospital, have isolated a gene believed to be responsible for allowing the body to fight off a host of infections, including tuberculosis, salmonella, and leprosy. Their discovery holds the promise of finding new ways to counter such diseases and raises the possibility of making use of sophisticated gene therapy to enhance the body's disease-fighting powers.
- Nearly four million Canadians over the age of 15 have chronic pain problems, and many cannot get access to the limited number of specialized pain treatment services. **Sandra Lefort** has worked with a team at Memorial University and the University of Toronto to develop the Chronic Pain Self-Management Program, a 12-hour education program. The program has been successfully tested in St. John's, Newfoundland, and is being tested in four other locations before being made available nationally.
- **Frances Abbott**, of McGill University, is also focusing on pain. She is studying chemicals the body deploys to cope with injury and inflammation. Some of these chemicals appear to play a role in sending pain signals to the brain, and Dr. Abbott believes that one of these may be responsible for making pain last.
- **Judes Poirier**, of the Douglas Hospital in Montreal, has developed a blood test to determine a person's chances of developing Alzheimer's disease. The test can tell whether someone carries the "bad" gene — apolipoprotein — that is responsible for killing the neurons in the brain that control memory.
- **Leigh Field**, a researcher at the University of Calgary, has discovered two genes that produce susceptibility to juvenile onset, or Type 1, diabetes. This is the most severe form of the disease, requiring daily injections of insulin to stay alive. An estimated 100,000 Canadians have this form of the disease, which strikes one in 300 children.
- **Anne Bassett**, of Toronto's Queen Street Mental Health Centre, has followed a small number of families affected by schizophrenia over three generations. She and her team of researchers have found that the disease is inherited, and that it appears to worsen with each generation. Researchers believe several genes are responsible for affecting brain development in people with schizophrenia.

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• **Cathy Logan**, of the University of Calgary, has identified two genes that may play a crucial role in the development of nerve cells that relay sensory information from the periphery of the body to the brain. She is studying these genes by introducing them into nerve cells where they are not present, and looking for changes in those cells. Her research could help in the development of therapies for birth defects such as spinal bifida, as well as therapies to repair degenerating sensory systems.

A predominant feature of the 1990s was the federal government's efforts to fight the deficit. Despite the government's recognition of the importance of science technology to the growth of Canada's economy, the research granting councils were not immune to deficit-related cuts. The federal budgets of 1995 and 1996 included 10 per cent from MRC's operating funds, followed by a three per cent decrease in 1997. By 1998, MRC had lost \$31 million in annual funding.

This placed particular pressure on MRC's ability to continue to fund excellent research at the same time that it had decided to expand its coverage to include other areas of health research. Less money had to be stretched in more directions.

The decision to actively pursue alliances with partnerships alleviated some of the pain. Additional funds were leveraged from other members of the health research community, including the voluntary and private sectors. Nevertheless, the impact of the budget cuts on basic research in particular was severe.



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The Funding Gap

In 1990, the MRC's grant budget fell by 10 per cent (adjusted for inflation) with two key aspects:

- the difference between the number of research proposals approved for funding and the number that could be approved if sufficient funds were available;
 - the difference between the amount of money peer review committees recommended that a particular grant should receive and the amount approved by MRC. Each year, funding levels were reduced in order to fund more grants.
- In 1990-91, MRC was unable to fund 835 excellent proposals, representing a gap of \$30 million. The average value of an MRC grant has increased 35 per cent since 1990, compared to less than 60 per cent in the United States.

The Canadian health research community was determined to keep Canada's health research funding at internationally competitive levels. It focused its efforts on convincing the federal government that restoring the budget cuts to research should be an immediate priority once the deficit fight was declared won. The government heeded the call, and, in its 1998 budget, restored MRC's core funding with an increase of \$130 million over three years. Funding

was also restored to the other two federal granting councils, the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Social Sciences and Humanities Research Council of Canada (SSHRC).

Today, with a 1999-2000 budget of more than \$300 million, MRC funds the research projects of more than 3,000 health scientists and provides salary support for more than 500 of the most outstanding. The Council also supports more than 2,700 Canadians as they train to become the researchers of tomorrow and, through project funding, finances the health research activities of nearly 10,000 Canadian scientists, technicians, and research assistants.

Throughout MRC's existence, peer review has been the backbone of the organization. Peer review has ensured that funded research meets internationally accepted standards of excellence. The MRC's peer review process has itself been recognized around the world as an exemplar of the "gold standard" of peer review.

All MRC research funding applications are subject to the MRC's internationally renowned peer review process. This independent review system for assessing applications involves the very best health scientists in Canada and around the world. More than 500 individuals volunteer their time and talents on more than 40 different peer review committees charged with reviewing

The Funding Gap

Throughout the 1990s, as MRC grappled with budget cuts, a "funding gap" emerged, with two key aspects:

- the difference between the number of excellent proposals approved for funding and the number that could be approved if sufficient funds were available;
- the difference between the amount of money peer review committees recommended that a particular grant should receive and the amount approved by MRC. Each year, funding levels were reduced in order to fund more grants.

In 1998-99, MRC was unable to fund 835 excellent proposals, representing a gap of \$60 million. The average value of an MRC grant has increased 16 per cent since 1990, compared to more than 60 per cent in the United States.

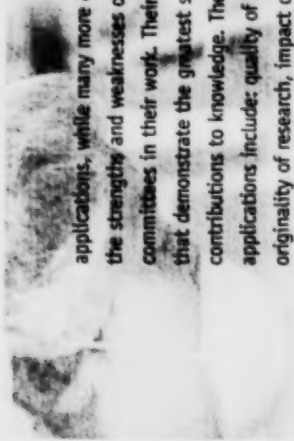
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applications, while many more contribute written assessments of the strengths and weaknesses of individual proposals to assist the committees in their work. Their goal is to select the applications that demonstrate the greatest scientific merit and potential for contributions to knowledge. The criteria used to evaluate applications include: quality of the science, breadth of vision, originality of research, impact on the health of Canadians, feasibility, and potential attractiveness to collaborators and funding partners.

Following the decision to expand MRC's activities to encompass the full spectrum of health research, MRC Council created new peer review committees to enhance its ability to review research proposals in population health, determinants of health, health care delivery, health economics and other social and behavioural aspects of health.

The peer review system is the best available guarantee to government and to the Canadian public that taxpayers' dollars are being directed to science of the highest quality.

Health research: Part of our cultural identity

Canada is blessed with talented, hard-working researchers who get results far beyond their numbers and resources. As a nation, our accomplishments in health research far outweigh our small population and our limited investment. In fact, our impact on international research is significant:

Funding health research in Canada

MRC is but one of Canada's many funders of health research. At the federal level, MRC is the single largest funder, with a budget of more than \$300 million. Several other federal bodies also contribute to the goal of achieving better health for Canadians:

- The **Natural Sciences and Engineering Research Council** spends about \$10 million each year on health-related research in the life sciences, bioengineering, and medical devices.
- The **Social Sciences and Humanities Research Council** is estimated to spend about \$3 million each year on the social, cultural, and behavioural aspects of health.
- **Health Canada** funds research in its own laboratories on the epidemiology and control of diseases, on the safety

of funds and instruments used on medical devices. As well, through the Health Foundation Fund, it funds research on health care delivery.

Within Health Canada, the National Health Research and Development Program spends about \$12 million each year on health research priorities, including the determinants of health, the health impact of public policies, mental and restructuring of the health care system and the transfer and uptake of knowledge.

The Canadian Foundation for Research (CFR) was created in 1977 as an anti-length organizations funding research-related infrastructure in universities, hospitals, and research institutions. Since its creation, almost half of all CFR investments have been in the area of health research.

The Canadian Health Services Research Foundation (CHSRF) was created in 1996, with an initial budget of \$65 million over five years, increased to \$100 million in the 1999 federal budget. CHSRF funds research on health systems.

The MURKIN Fund, announced in the 1999 federal budget, will allow \$20 million to finance research on critical issues related to nursing and the delivery of health care. The Fund is administered by the CHSRF.

In addition, under existing research institutions, the private sector and provincial governments also provide funding for health research. In 1999-2000, Statistics Canada estimated that \$1.6 billion flowed into health R&D through these additional channels.

- Canada ranks fourth in the world in per capita, ahead of both the United States (third) and the United Kingdom (second).
- Canada ranks first in the world in per dollar spent on research.
- As measured by citations per dollar, Canada is second in the world in clinical research in biomedical research, and third in commercial research relevant to health.
- Every year, Canadian researchers receive more than half of the grants that the U.S. National Institutes of Health (NIH) gives to foreign researchers. In 1998, Canadian researchers received US\$13.5 million from the seven other countries in the top 10 in international awards among them.
- Canadian researchers were awarded 43 per cent of International Howard Hughes Medical Institute awards by the Howard Hughes Medical Institute. These

A LEGACY OF EXCELLENCE

THE MEDICAL RESEARCH



awards provide support for five years to researchers who are judged to have the potential to make significant contributions to the study of basic biological processes or disease mechanisms. All of the Canadian winners of International Scholarships from the HHMI have received grant support from MRC, and are in turn training MRC research fellows or students.



From the discovery of insulin in 1921 to today's multi-disciplinary research breakthroughs, health research in Canada has come a long way. As a result, most Canadians know someone who is alive and well thanks to advances in scientific knowledge — and someone who could not be cured because the knowledge has not yet advanced far enough. As well as supporting health research

organizations such as the MRC through their federal tax dollars, Canadians contribute greatly to universities, hospitals, and other community organizations. This generosity clearly illustrates the importance we place on health, and our understanding of the fact that quality health care rests on the foundation of a strong research enterprise.

Continuing the tradition of excellence

MRC-funded researchers continue to make the discoveries that make a difference to the lives and health of Canadians and people around the world. The following are just some examples of the 3,000 researchers currently being funded by the MRC whose work will be encompassed in the new Canadian Institutes of Health Research.

- **Kristian Aronson**, of Queen's University, is comparing concentrations of certain environmental chemicals (such as pesticides, PCBs, and heavy metals) in the blood of men with prostate cancer and a control group of healthy men, to identify what, if any, role these chemicals may play in rising levels of the cancer. Her findings could help to design strategies to prevent this cancer.

of foods and medicaments, and on medical devices. As well, through the Health Transition Fund, it funds research on health care delivery.

- Within Health Canada, the **National Health Research and Development Program** spends about \$12 million each year on health research priorities, including the determinants of health, the health impact of public policies, renewal and restructuring of the health care system, and the transfer and uptake of knowledge.
- The **Canada Foundation for Innovation (CFI)** was created in 1997 as an arm's-length organization funding research-related infrastructure in universities, hospitals, and research institutes. Since its creation, almost half of all CFI investments have been in the area of health research.
- The **Canadian Health Services Research Foundation (CHSRF)** was created in 1996, with an initial budget of \$65 million over five years, increased to \$100 million in the 1999 federal budget. CHSRF funds research on health systems.
- The **NURSE Fund**, announced in the 1999 federal budget, allocates \$25 million to finance research on critical issues related to nursing and the delivery of health care. The Fund is administered by the CHSRF.

In addition, health charities, research foundations, the private sector, and provincial governments also provide funding for health research. In 1998-99, Statistics Canada estimated that \$1.6 billion flowed into health R&D through these additional channels.

- Canada ranks fourth in the world in terms of publications per capita, ahead of both the United Kingdom (which is eighth) and the United States (ninth).
- Canada ranks first in the world in terms of citations per dollar spent on research.
- As measured by citations per paper published, Canada ranks second in the world in clinical research, fourth in biomedical research, and third in community health and social sciences relevant to health.
- Every year, Canadian researchers win more than half of all the grants that the U.S. National Institutes of Health (NIH) gives to foreign researchers. In 1998-99, Canadian researchers received US\$17.5 million in grants from NIH; the seven other countries in the top eight recipients of international awards received a total of US\$12 million among them.
- Canadian researchers were awarded 20 out of 47 (43 per cent) International Research Scholar awards by the Howard Hughes Medical Institute (HHMI) in 1997. These

awards provide support for five years to researchers who are judged to have the potential to make significant contributions to the study of basic biological processes or disease mechanisms. All of the Canadian winners of International Scholarships from the HHMI have received grant support from MRC, and are in turn training MRC research fellows or students.

Brett Finlay, a Professor of Biotechnology, Biochemistry, and Molecular Biology at the University of British Columbia, was selected as one of only two speakers from around the world for the Howard Hughes Medical Institute's Holiday Lecture on Science for 1999. The free lectures are broadcast live on the World Wide Web and by satellite to enable high school students to see and hear presentations by some of the world's leading biomedical researchers.

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- **Dr. Louis Delbaere** and his colleagues at the University of Saskatchewan have found a receptor site where a drug displaying potential anti-cancer properties binds to a key protein that helps to regulate cell propagation and growth. Their goal is to find a drug that will attack only cancerous cells, and leave healthy cells alone.
- **Mark Weinberg**, of McGill University, is focusing on how to combat HIV resistance to AZT and other drugs, in order to develop a comprehensive model of cost-effective care for treating HIV infection and disease.
- **Karl Riabowol** and **Igor Garkavtsev**, of the University of Calgary, discovered that an important gene is absent in cancer cells. This gene produces a substance that tells normal cells when to stop growing. When the two researchers exposed breast cancer cells to high levels of the gene products, the cancer cells stopped growing, leading to hopes for a technique to suppress the growth of cancer.
- **Ravi Menon**, at the University of Western Ontario, has been using Magnetic Resonance Imaging (MRI) to determine, with his colleagues in neurology, psychiatry, and physiology, how best to diagnose and treat patients with schizophrenia.
- **William Muller**, from McMaster University, is investigating two of the 20 to 30 cancer-causing genes. He has found that mutations in one of these genes are present in about one third of all human breast cancers, while mutations in the other are a factor in roughly half of all breast cancers. He is trying to find an agent that will block the gene and interfere with the process of tumour formation.
- **Janice Eng**, from the University of British Columbia, is studying what aspects of balance and gait problems experienced by people with Parkinson's disease would be helped by surgery.
- **Jeffrey Charuk**, **Reinhard Reithmeier**, and **Arthur Grey**, from the University of Toronto, have found that the same type of detergent found in commonly used household products can reduce the amount of chemotherapy drugs needed to treat multi-drug resistance. They discovered that by studying the role of a naturally occurring drug called P-glycoprotein that is found in high levels in the cell membranes of certain drug-resistant cancer cells, their discovery could offer a useful adjunct to chemotherapy treatments.



- **Peggy Olive**, of the B.C. Cancer Research Centre, is seeking to understand how chromatin organization influences the ability of cells to repair damage caused by ionizing radiation. Evidence indicates that 30 to 40 per cent of tumours are resistant to killing by certain kinds of radiation. Discovering the mechanism behind this cell structure-related resistance can help in detecting tumours with this kind of resistance, measuring intrinsic tumour radiosensitivity, and providing new approaches to improving tumour response to radiation therapy.
- **Proton Rahman** is studying 60 Newfoundland families to find the gene that causes psoriatic arthritis — a less common form of arthritis that affects men and women between the ages of 20 and 50, and that is 10 per cent more common in Newfoundland than in the rest of the Caucasian population. His ultimate goal is to find a cure for the condition.



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Chapter 2: Supporting Excellence for 40 Years

INVESTMENT IN HEALTH RESEARCH IS, FIRST AND FOREMOST, AN INVESTMENT IN PEOPLE. OVER THE PAST 40 YEARS, MRC HAS INVESTED CLOSE TO \$4.5 BILLION IN CANADA'S BEST AND BRIGHTEST HEALTH RESEARCHERS, GENERATING NEW KNOWLEDGE THAT HAS IMPROVED THE HEALTH OF CANADIANS AND OF PEOPLE AROUND THE WORLD.

MRC invests in health researchers through two channels:

- Awards in the form of salary support and support for research training. These awards support individual scientists in their work. They help to build capacity in the health research enterprise, ensuring that there is a critical mass of excellent health researchers who are encouraged and supported to apply their knowledge, skills, and creativity to the conundrum of health.
- Grants for specific research proposals support basic, applied, and clinical research projects in the health sciences, as proposed and carried out by investigators in laboratories in Canadian universities and their affiliated research institutes. These grants generate the knowledge and discoveries that lead to new ways to prevent ill health and disease, and new ways to treat them when they occur.

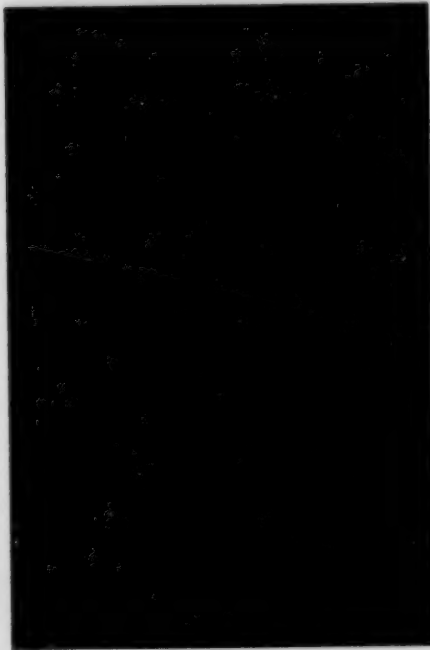
Building a dynamic, ongoing health research enterprise must be a sustained affair. Regular, ongoing funding is needed to ensure its continued success. Over 40 years, MRC has provided the continuity of funding that has enabled researchers to achieve their best — right here in Canada.

Over its 40-year existence, the MRC has funded 68,458 research grants and 19,456 personnel awards on resident Canadian researchers. Over this period, an additional 300,000 person-years of research (scientists, technicians, and research support staff) have been supported by the MRC.

MRC: Federal Grants and Personnel

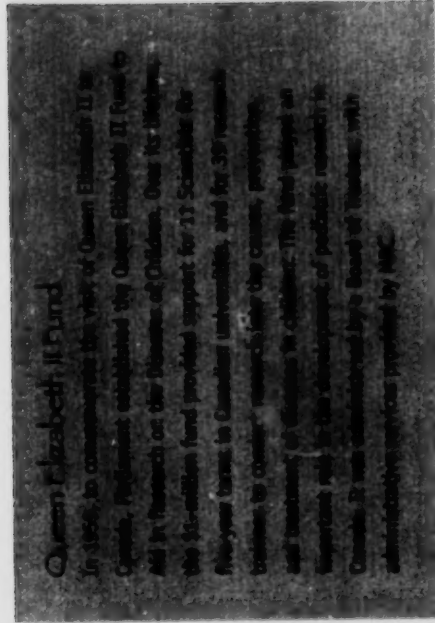
	Operating Grants	Program and Other Grants & Awards	Equipment Grants
1976	22,467	20,672	840
1981	35,981	16,587	1,316
1986	13,917	8,134	589
1991	8,305	3,041	767
Total	60,750	47,434	3,412

Awards: Building research capacity throughout Canada



The cycle of research innovation begins with students. Without the initial fascination to which so many researchers attribute their initial attraction to science, without the initial harnessing of that fascination, there would be no health research enterprise in Canada. MRC is the one health research funder in Canada that has consistently supported researchers from the earliest stages of their careers. In the past ten years alone, more than 7,300 researchers have received MRC awards.

THE MEDICAL RESEARCH COUNCIL OF CANADA



Because the majority of health research in Canada takes place in universities, rather than in central research institutes, a way had to be found to support those researchers who wanted to devote themselves to research, rather than to the teaching and administrative work that most faculty members must undertake. Over the years, MRC has established several programs to recognize the best Canadian researchers at different stages of their careers, and to support their full-time involvement in research.

At the earliest phase, MRC studentships, such as the Farquharson Research Scholarships, provide funding for summer employment for medical students in research laboratories in hospitals and

A LEGACY OF EXCELLENCE



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Over its 40-year existence, the MRC has bestowed 66,450 operating grants and 47,434 personnel awards on excellent Canadian researchers. Over that period, an estimated 300,000 person-year positions (scientists, technicians, and research support staff) have been supported by the MRC.

MRC Annual Grants and Expenditures

	Operating Grants	Personnel and Other Grants & Awards	Equipment Grants
1990s	23,487	20,672	940
1980s	18,991	14,587	1,114
1970s	15,167	9,134	589
1960s	6,805	3,041	767
Total	66,450	47,434	3,410

MRC invests in health researchers through two channels:

- **Awards** in the form of salary support and support for research training. These awards support individual scientists in their work. They help to build capacity in the health research enterprise, ensuring that there is a critical mass of excellent health researchers who are encouraged and supported to apply their knowledge, skills, and creativity to the conundrum of health.
- **Grants** for specific research proposals support basic, applied, and clinical research projects in the health sciences, as proposed and carried out by investigators in laboratories in Canadian universities and their affiliated research institutes. These grants generate the knowledge and discoveries that lead to new ways to prevent ill health and disease, and new ways to treat them when they occur.

Building a dynamic, ongoing health research enterprise must be a sustained affair. Regular, ongoing funding is needed to ensure its continued success. Over 40 years, MRC has provided the continuity of funding that has enabled researchers to achieve their best — right here in Canada.

Awards: Building research capacity throughout Canada

"Throughout my professional life in Canada, the MRC has been an important source of my research funding and the main source of my professional income, first as a Research Assistant on a project grant to a colleague, and, from 1968 to 1993, as an MRC Research Associate I salute the MRC for its short-term investment in curiosity-driven research, and for its long-term investment in personnel. The outcome of the latter is harder to evaluate, but in the long run is, I believe, as important in establishing a culture of scientific enquiry as it is an integral component of medical teaching and practice."

Margaret R. Becklake

The cycle of research innovation begins with students. Without the initial fascination to which so many researchers attribute their initial attraction to science, without the initial harnessing of that fascination, there would be no health research enterprise in Canada. MRC is the one health research funder in Canada that has consistently supported researchers from the earliest stages of their careers. In the past ten years alone, more than 7,300 researchers have received MRC awards.

Queen Elizabeth II Fund

In 1959, to commemorate the visit of Queen Elizabeth II to Canada, Parliament established the Queen Elizabeth II Fund to Aid in Research on the Diseases of Children. Over its lifetime, the \$1-million fund provided support for 11 Scientists for five-year terms in Canadian universities, and for 39 research trainees to conduct research into the causes, prevention, and treatment of diseases in children. The fund played an important role in the development of pediatric research in Canada. It was administered by a Board of Trustees, with administrative services provided by MRC.

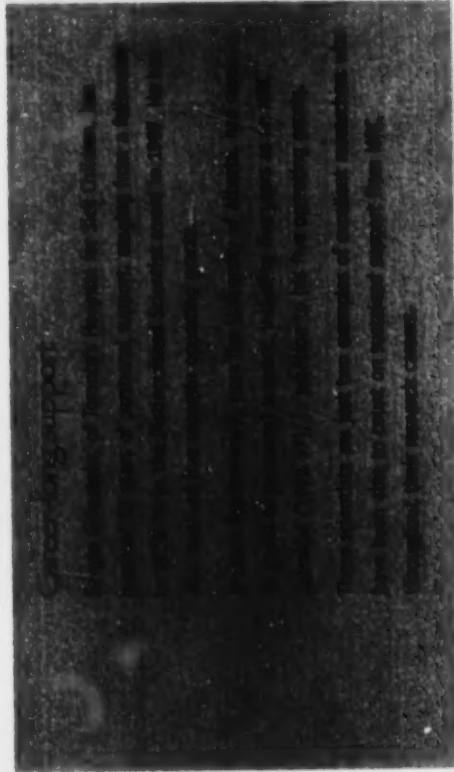
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At the earliest phase, MRC studentships, such as the Farquharson Research Scholarships, provide funding for summer employment for medical students in research laboratories in hospitals and



universities across the country. In recent years, the Burroughs Wellcome Fund has provided support for awards to all Canadian schools of medicine, dentistry, pharmacy, and optometry to give undergraduate students exposure to research. Doctoral research awards are another source of support for graduate-level studies toward an M.S.C. or Ph.D.

Researchers who have completed their doctoral degrees are eligible for post-doctoral fellowships. These permit recent graduates to pursue research under the guidance of an established mentor, publish their research findings, and work toward establishing a career as an independent scientist.



The most prestigious fellowship award has been the Centennial Fellowship, which was offered for the first time in 1967. These fellowships were awarded to young researchers who had achieved special academic distinction to allow them to broaden their fields of interest and equip themselves for independent work in clinical investigation and interdisciplinary research. Up to 10 Centennial Fellowships were awarded each year, providing a unique opportunity for young investigators to expand their research horizons at a time when extended post-doctoral training was uncommon. In 1999, the Centennial Fellowships were converted into a unique award combining two years of senior post-doctoral support with two years of support for a first faculty position.

The current system of personnel awards for independent investigators began in 1975. Researchers can follow a path of staged five-year awards, from Scholar, to Scientist, to Senior Scientist, to Distinguished Scientist. Only the very best in each category are rewarded with promotion to the next category.

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Career-long support

Sergio Grinstein, of Toronto's Hospital for Sick Children, has received 13 years of personnel support, ranging from a fellowship in 1976-78 to the Distinguished Scientist award in 1997. He has also received five separate operating grants.

Richard Bachubinski, from the University of Alberta, has received 14 years of personnel support, including five years as an MRC Scientist (1992-97), in addition to his five operating grants.

These scientists are just two examples of excellent researchers who have been able to count on sustained support from MRC throughout their research careers.



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The MRC Research Career Ladder

Recognition

Distinguished Scientist (20)
Senior Scientist (24)

Career Development

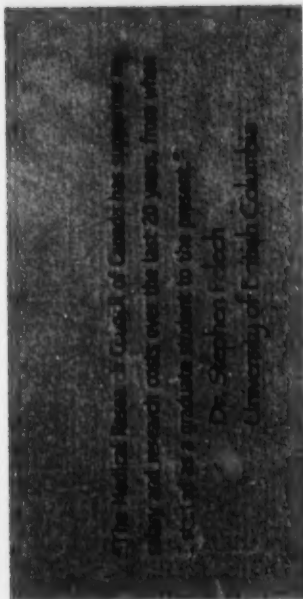
Scientist (81)
Scholarship (194)

Training

Fellowship (407)
Graduate Student Award (604)
Summer Research Award (305)

* Numbers refer to 1998-1999





Scholarships were created in 1962 to support researchers assuming their first faculty appointments. The award, which is limited to five years, permits trained investigators to develop their ability to initiate and carry out independent research unhampered by the heavy teaching duties often expected of regular faculty members. MRC Scholarships have been the first step in the successful careers of many of Canada's outstanding health researchers of today.

The **MRC Scientist** program was created in 1982 to allow outstanding scientists with proven research accomplishments to devote themselves to full-time research. The program, which is aimed at established researchers, was designed to provide an increased number of research career positions over and above those provided by Scholarships.



Associateships, the most senior level of support, were first offered in 1956. These lifetime awards, renewable every five years, were designed to facilitate long-term planning and development of research in the health sciences in Canadian universities, and were awarded to a limited number of individuals of outstanding ability and training. These awards, later known as Career Investigators Awards, were discontinued in 1975, and terminated at the end of 1999.

The **Senior Scientist Program**, which has replaced the Associateship/Career Investigator Program, is designed to contribute to the salaries of scientists of exceptional merit who are leaders in their field. It is intended to support researchers with nine to 15 years of experience.

"The Medical Research Council of Canada has supported my salary and research costs over the last 20 years, from when I started as a graduate student to the present."

Dr. Stephen Felech
University of British Columbia

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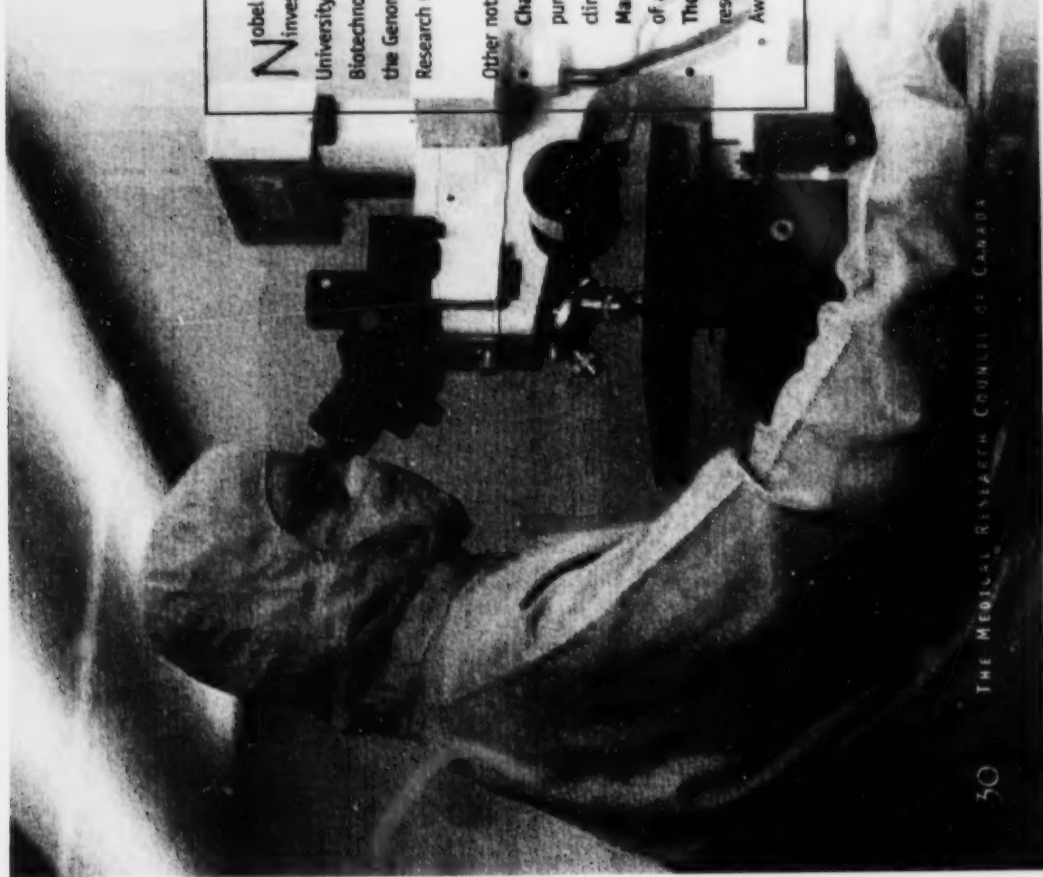
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"It was not until 1998, when I received an MRC Scientist Award, that for the first time I have been able to stop worrying about finding salary support. Now I am able to devote my time to my research and to mentoring my trainees and other young investigators."

Dr. Rosemary Tarrack

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Nobel Laureate **Michael Smith** has been an associate/career investigator with MRC since 1966. He is currently the Killam University Professor and Peter Wall Distinguished Professor of Biotechnology at the University of British Columbia and Director of the Genome Sequence Centre at the British Columbia Cancer Research Centre in Vancouver.

Other noted MRC associates/career investigators include:

Charles T. Beer, known for his research in isolating and purifying vinblastine, the first member of a new class of clinically useful anti-cancer agents

Margaret R. Becklake, who has focused on the epidemiology of airway disease

Thomas Ming Swi Chang, who has been supported in his research into artificial cells with an MRC Fellowship, Scholar Award and Associateship

The Distinguished Scientists Awards provide world-class researchers who have 15 to 20 years of experience with the opportunity to focus on specific research problems. These are individuals who constantly challenge accepted models and theories. They undertake unending expansion and reformulation of their work to incorporate the newest techniques and research findings. They are exceptional in the quality of their reputation internationally, and the strength of their collaborations around the world.

For promising newcomers to Canada's internationally renowned research community, the MRC is proud of its role as a primary generator of research capacity in Canada and a significant contributor to the cycle of innovation.



42 A L C O F E V L E C E 3
41 40 3

MRC Distinguished Scientists

1999:

Kenneth Boyd, University of Toronto
Joseph Culbert, University of Toronto, Samuel Lunenfeld Research Institute, Mount Sinai Hospital
Beth Jagoe, University of Alberta
Anna Kitz, University of Toronto, Hospital for Sick Children
Jack Steinberg, Université du Québec, Institut national de la recherche scientifique, Institut Armand Frappier

1998:

George Chrousos, University of Western Ontario
Patrick McArthur, Dalhousie University
Anthony Poon, Samuel J. Lunenfeld Research Institute

1997:

Harold Akman, University of Toronto
Chris Mackinnon, University of Alberta
Brenda Galla, University of Toronto
Sergio Grinstein, University of Toronto
Michael Krausz, McGill University
Léon Sirois, Sherbrooke University

1996:

Robert Prasad, University of Calgary
Fernand Daries, Centre de recherche du Centre hospitalier de l'Université de Laval

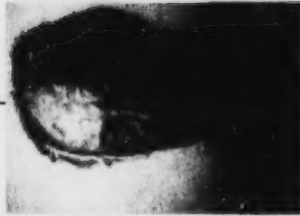
Yiguo Peng, McGill University
 Janet Rossant, University of Toronto
 Robert Steinberg, McGill University

1995:

Jack Greenblatt, Charles H. Best Institute, University
 of Toronto
 Robert Hancock, Bacteriological Diseases MRC,
 University of British Columbia
 Lee Ratnesar, Loeb Medical Research Institute,
 University of Ottawa
 Nadell Sadek, Clinical Research Institute, Université
 de Montréal
 Charles Schrier, McGill University

Michael Smith Award for Excellence

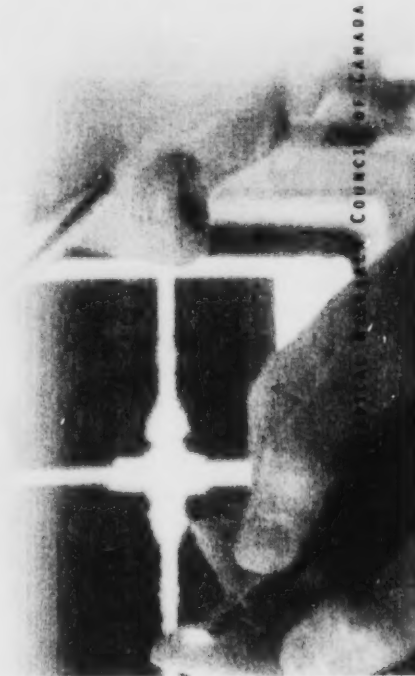
In 1993, Dr. Michael Smith, a renowned MRC Career Investigator, was awarded the Nobel Prize for Chemistry for his discovery and development of a technique called site-directed mutagenesis, which is used in genetic engineering. The MRC has recognized Dr. Smith's lifelong commitment to science and to encouraging other health researchers by creating the Michael Smith Award for Excellence.



Dr. Michael Smith

The award, which consists of a medal plus \$50,000 to be used by the awardee to further his or her research program, is presented annually to an outstanding Canadian investigator with fewer than 12 years experience, but who has demonstrated innovation, creativity and dedication to health research. Recipients of the Michael Smith Award for Excellence are:

- 1999: **Michael Tyers**, Samuel Lunenfeld Research Institute, Mount Sinai Hospital
- 1998: **David Naylor**, Institute of Clinical Evaluative Sciences, Toronto
- 1997: **John Dick**, Hospital for Sick Children
- 1996: **Peter St. George-Hyslop**, University of Toronto
- 1995: **John Waller**, University of Calgary
- 1994: **Philippe Gros**, McGill University



STYAN RESEARCH COUNCIL OF CANADA

The **Distinguished Scientists Awards** provide world-class researchers who have 15 to 20 years of experience with the opportunity to focus on specific research problems. These are individuals who constantly challenge accepted models and theories. They undertake unending expansion and reformulation of their work to incorporate the newest techniques and research findings. They are exceptional in the quality of their reputation internationally, and the strength of their collaborations around the world.

From promising newcomers to Canada's internationally renowned scientific pioneers, the MRC is proud of its role as a primary generator of research capacity in Canada and a significant contributor to the cycle of innovation.

MRC Distinguished Scientists:

1999:

Norman Boyd, University of Toronto
Joseph Culotti, University of Toronto, Samuel Lunenfeld Research Institute, Mount Sinai Hospital
Bodh Juggutt, University of Alberta
Amira Klip, University of Toronto, Hospital for Sick Children
Jack Siemiatycki, Université du Québec, Institut national de la recherche scientifique, Institut Armand Frappier

1998:

George Chaconas, University of Western Ontario
Patrick McGrath, Dalhousie University
Anthony Pawson, Samuel J. Lunenfeld Research Institute

1997:

Harold Atwood, University of Toronto
Chris Bleakley, University of Alberta
Brenda Gallie, University of Toronto
Sergio Grinstein, University of Toronto
Michael Kramer, McGill University
Léon Sanche, Sherbrooke University

1996:

Robert French, University of Calgary
Fernand Labrie, Centre de recherche du Centre hospitalier de l'Université de Laval

42 A LEGACY OF EXCELLENCE 41

Yogesh Patel, McGill University
Janet Rossant, University of Toronto
Nahum Sonenberg, McGill University

1995:

Jack Greenblatt, Charles H. Best Institute, University of Toronto
Robert Hancock, Bacteriological Diseases NCE, University of British Columbia
Léo Renaud, Loeb Medical Research Institute, University of Ottawa
Nabil Seidah, Clinical Research Institute, Université de Montréal
Charles Scriver, McGill University

Michael Smith Award for Excellence



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- 1995: **John Waller**, University of Calgary
- 1994: **Philippe Gros**, McGill University

Grants: Generating new knowledge

Basic, curiosity-driven research, is at the heart of the health research enterprise. It is research that asks original questions in the pursuit of new knowledge. It is the foundation upon which all other research develops. Basic research is carried out by researchers with a vision, and the determination to test their vision. The result is fundamental knowledge that helps to solve some of the world's most pressing problems. It is this important research that is at the heart of the MRC grants program.

Basic research is a long-term investment that may bear fruit only after many years of work. MRC funds grants over several years — up to seven years for some clinical trials — so that investigators have the security they need to carry out difficult research that may not yield immediate results.

The majority of MRC grants are awarded to researchers affiliated with one of the 16 universities in Canada with medical schools. Health research, however, covers a wide spectrum, and health researchers can also be found in many other faculties in other universities, including nursing, rehabilitation therapy, dentistry, pharmacy, psychology, sociology, and economics. Thus, MRC-funded

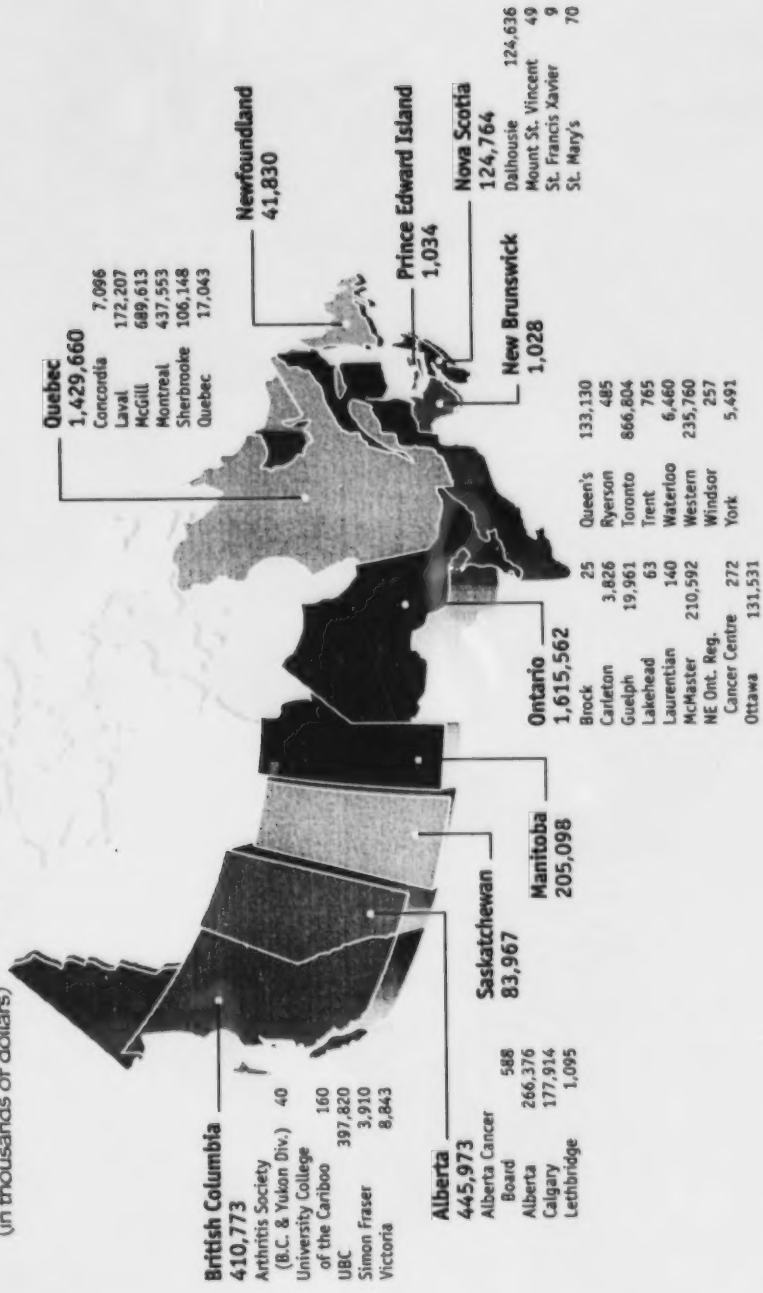
researchers can be found at the University of Toronto, McGill University, Dalhousie University, and the University of British Columbia — but also at the University College of the Cariboo in British Columbia, Alberta's Lethbridge University, Ontario's Trent University, and the University of Prince Edward Island.

Given the wide spectrum of disciplines that health research encompasses, it is not surprising that, at the country's 16 universities with medical schools, 55 per cent of all university research dollars are invested in the area of health — that underscores how support for health research is a fundamental value among Canadians.

The following diagram illustrates the allocation of MRC grants and awards among Canada's universities and other research institutions over the past 40 years.



Allocation of MRC Grants and Awards 1960 - 1999 (in thousands of dollars)



MRC continues to expand the research it supports, covering the full spectrum of health research, including basic biomedical, clinical, health services and health systems, behavioural and social determinants of health, psychological health, and population health. A brief look at recent research funded by MRC illustrates the importance of support for health research in improving the lives of Canadians:

Brain Function

- At the research centre of Hôpital Côte-des-Neiges in Montreal, a group directed by **André Roch Lecours** revealed new findings concerning the effects of aging on brain functions. Researchers have discovered that normal aging can have an impact on almost all aspects of linguistic behaviour.
- **Harold Robertson** of Dalhousie University is studying the phenomenon known as "kindling" that occurs when the brain works differently because of activity in the brain cells. Kindling is usually associated with a part of the brain called the hippocampus which has a central role in memory. Understanding kindling could teach us a great deal about epilepsy.

Cancer

- One of the major challenges to cancer research is the ability to develop drugs that can selectively target cancer cells. **Cole and Rogers** of the University of Alberta have discovered that makes a new class of drugs that target off this gene, which would be rendered more vulnerable to chemotherapy.
- **Karl Rhabowol** of the University of Calgary has discovered a gene that could shorten the life of cancer cells by eliminating them as they appear. His research focuses on finding out how cancer cells avoid this gene and discovering how to counter this phenomenon.

Cardiovascular Disease

- **Jack Hirsh** and his team of researchers at McMaster University are leaders in developing treatments for thrombosis. Their most noteworthy achievements include demonstrating that low molecular weight heparin and warfarin can effectively prevent deep venous thrombosis and pulmonary embolism.

- **Salim Yusuf** and his colleagues at McMaster reported this year in the HOPE Study that using beta blockers, aspirin, thrombolytic (clot-buster) agents and ACE-inhibitors (a special kind of blood pressure lowering agent), substantially improved survival after heart attack and lowered the risk of subsequent heart attacks. Yusuf is also part of the SHARE study (with the MRC and Heart and Stroke Foundation) which is examining 1,000 people from Toronto, Edmonton and Hamilton in an effort to find out if genetic or lifestyle differences are behind markedly differing risks for heart attacks among different ethnic groups.

Diabetes

- **Ji-Won Yoon**, at the University of Calgary, has found a trigger for diabetes — an enzyme produced in cells in the pancreas, called glutamic acid decarboxylase (GAD). Children who develop diabetes have an off-kilter immune system that allows the body's infection-fighting T-cells to attack the GAD enzyme when they should not, harming the pancreas and destroying the body's ability to produce enough insulin, resulting in Type 1 diabetes. He has developed a GAD vaccine for newborns that would build up a tolerance for the enzyme among T-cells and prevent them from destroying GAD later.

Genetics

- **Peter St George-Hyslop**, Professor of Medicine (Neurology) and Director of the Centre for Research in Neurodegenerative Diseases at the University of Toronto, was the first to demonstrate that Alzheimer's disease is not one single disorder. He and his team mapped and cloned a new family of genes called "presenilins" which, when mutated, are responsible not only for the aggressive early form of the disease, but also play an important role in all of its other forms.

Infectious Diseases

- Viruses that infect animals as well as people can have repercussions on human health. **Lorne Babiuk**, of the University of Saskatchewan, is studying viruses such as herpes in order to discover how they infect cells, how animal organisms react to them and what role genes play in the process. The results of this research should provide a better understanding of this disease among humans.
- Researchers at the University of Manitoba led by **Francis Allan Plummer** are studying individuals who appear to have immunity to HIV infection, a discovery which may advance



research on HIV vaccines. They are now trying to find a genetic factor that makes some people resistant to the HIV virus.

Motor Functions

- **Yves Lamarre** and a team of researchers at the Université de Montréal are studying motor diseases in the hope of developing better treatments to control tremors, and gaining new knowledge of normal motor functions and motor learning.

University of Alberta researchers **Richard Stein** and **Arthur Prochazka** are pioneers in the emerging field of functional electrical stimulation. Stein's research has led to the development of electrodes that can be implanted beneath the skin in order to establish permanent transmission of electrical signals between deep muscles and myo-electric prosthetic devices. This "touch control" technique has helped amputee musicians to continue to play. Prochazka is developing a bionic glove for quadriplegics that stimulates the muscles and nerves of the wrist in order to trigger thumb flexion, index opening and closing motions.



A LEAP IN INTELLIGENCE

Public Health

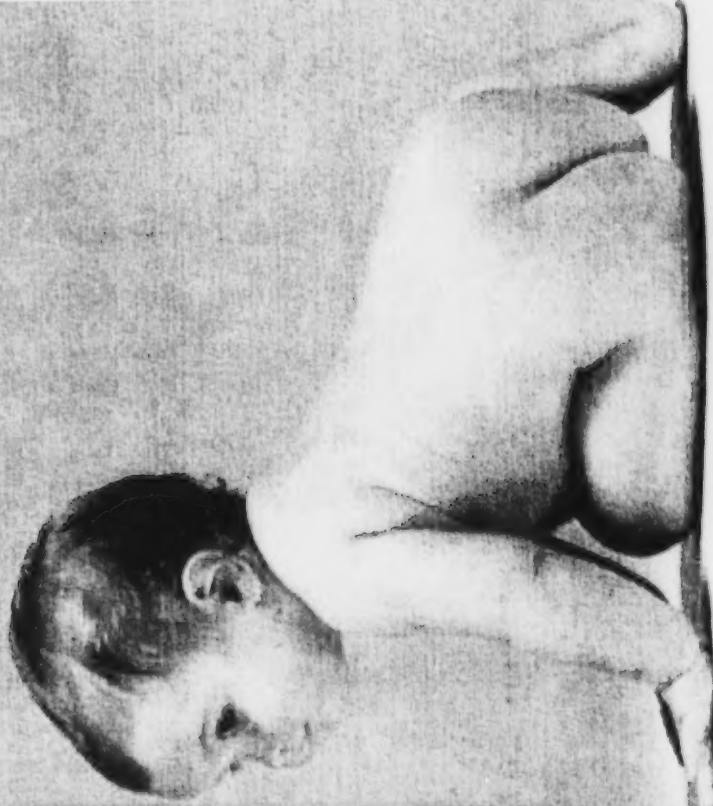
- One out of five Canadian families is a single-parent family, usually headed by a woman. **Marilyn Ford-Gilboe** and a team of researchers from the University of Western Ontario and the University of New Brunswick are studying the health of these families, particularly those broken up by violence or emotional abuse. The results of this study will make it possible to develop health programs and policies to support family health.
- **Katherine Gray-Donald**, **Moreen Willows** and **Johanne Morel** of McGill University are currently trying to discover the cause of anemia in Cree infants. In the northern Quebec region east of James Bay, Cree babies are four times more likely to be anemic than are babies born to urban, middle-class Canadian families and eight times more likely to have severe anemia. This research should contribute to the treatment and prevention of such anemia.

Did you know...

That the child-proof medication cap was created by a Canadian pediatrician?

Dr. Henri Breault practised medicine for 41 years in Windsor. As Director of the Poison Control Centre at the city's Hotel Dieu Hospital, he daily saw cases of children poisoned by medications in the home. He developed the child-proof cap in response. One year after its introduction, deaths by poisoning in the Windsor area alone were down by 90 per cent.

Dr. Breault was inducted into the Canadian Medical Hall of Fame in 1997.





Chapter 3: Partnerships — Expanding the Circle of Excellence

ONE OF THE KEY OUTCOMES OF MRC'S STRATEGIC PLANNING PROCESS OF THE EARLY 1990S WAS THE DECISION TO PROMOTE THE DEVELOPMENT OF ACTIVE PARTNERSHIPS WITH INVESTIGATORS, HEALTH CARE PROVIDERS, UNIVERSITIES, RESEARCH CENTRES AND INSTITUTES, FOUNDATIONS, AND PROVINCIAL GRANTING AGENCIES AND GOVERNMENTS. IN ADDITION, MRC FOCUSED ON STRENGTHENING ITS PARTNERSHIPS WITH INDUSTRY. TODAY, THE MRC HAS 60 PARTNERSHIP AGREEMENTS IN PLACE WITH THE VOLUNTARY AND NOT-FOR-PROFIT SECTOR, FEDERAL AND PROVINCIAL GOVERNMENTS, INDUSTRY, AND INTERNATIONAL HEALTH RESEARCH ORGANIZATIONS.

- facilitated linkages between researchers and other sources of research funding, including voluntary organizations and researchers
- functioned as a mechanism for linking government health policy with health research on issues of national importance, such as AIDS and breast cancer.

Preserving excellence while generating new investments

Over the past several years, the partnerships that MRC has established have helped to attain several strategic objectives. They have:

- brought together voluntary organizations, industry, and academia to promote a common agenda of investment in health research
- fostered better coordination and planning of common efforts
- increased the use of peer review to ensure that the best science is funded

Five principles have guided the MRC in its partnership development:

- Research projects must be related to health and must add value to the ongoing health research effort.
- Partnerships must have a national perspective, open to anyone in Canada, and not specific to an institution or university.
- Every project funded through an MRC partnership must first meet internationally accepted standards of excellence, as determined through the MRC's peer review process.

- Partnerships must provide a significant contribution for every dollar of MRC investment.
- Partnerships are to command no more than 10 per cent of the total MRC budget.

MRC's decision to pursue partnerships with the voluntary sector, with industry, with government, and with international organizations has contributed to a dramatic increase in the amount of money invested in health research in Canada. Research spending by pharmaceutical companies alone increased more than eight-fold between 1987 and 1997. In 1999-2000, MRC invested approximately \$21 million in partnerships, with partners contributing nearly \$62 million. These partnerships will result in approximately 724 grants and 749 personnel awards for Canadian researchers.

All partners benefit

MRC partnerships have created benefits for the Council, for its partners, for researchers, and for Canadians over the past decade.

For the MRC, partnerships provide added recognition and visibility with the voluntary sector. Many voluntary organizations have strong lobby groups and are active in advocating increases to the government's investment in health research. Partnerships also link

the MRC to large corporate sponsors, increasing the potential for future collaborations.

Partners benefit through their access to the MRC's system of peer review. Knowing that research has met accepted standards of excellence provides confidence and assurances to health research investors that they are funding good science. Organizations are more able to focus their efforts on raising funds for research, without having to use valuable resources in administering their own peer review process. In addition, MRC partnerships help to link voluntary agencies with researchers and personnel, helping them to identify champions in their area of interest.

Researchers benefit directly from partnerships, because of the increased number of grants and awards available to Canadian scientists. Partnerships, particularly those with industry, help to create high-quality employment for the researchers who are being trained in Canada's universities.

Finally, Canadians benefit — from increased research capacity in targeted areas of research that translates into better ways to prevent and treat disease; from increased dissemination of research results through voluntary and provincial government organizations and their networks; and from the economic growth and job creation that result from being able to commercialize the result of Canadian research in Canada.

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MRC partners: The voluntary sector

More than half of MRC's partnerships have been developed with the voluntary sector, including charitable and not-for-profit organizations. These organizations play an important role in Canadian health research, raising funds, supporting research, and disseminating research results to citizens. Partnerships with the voluntary health charities are resulting in increased coordination and planning of common efforts in building the health research capacity in Canada, with the ultimate goal of delivering the benefits of research to Canadians.

Examples of MRC partnerships with the voluntary sector are:

- The **Juvenile Diabetes Foundation (JDF)/MRC Partnership**, is a program investing in research to find a cure for this devastating disease and prevention of its complications. This program has made investments totalling \$13 million, of which \$9 million has come from the Juvenile Diabetes Foundation and \$4 million from the MRC.
- **Canadian Breast Cancer Research Initiative:** MRC contributes \$10 million over five years to this initiative, which is jointly run with the National Cancer Institute of Canada (NCIC), the NHRDP, the Canadian Cancer Society, the Avon Flame Foundation, and the Canadian Breast Cancer Foundation. The initiative supports a broad spectrum of

cancer research in Canada relevant to the prevention, early detection, diagnosis, treatment, rehabilitation and palliation for people with breast cancer. The ultimate goal of the program is to prevent, cure, and eradicate breast cancer and to enhance the lives of women living with the disease.

JDF/MRC funds research networks

Diane T. Finegood, of Simon Fraser University in B.C., Terry Delovitch and **Indragith Singh**, of the University of Western Ontario, **Alan Robb**, of the University of Alberta, and **Carolee Whitcombe**, of the University of Toronto are leading research networks that are seeking better ways to prevent and treat diabetes.

The network of Dr. Delovitch and Dr. Singh focuses on the molecular mechanisms of the development of insulinitis and its regulation in insulin-dependent diabetes mellitus (IDDM).

Dr. Finegood's network focuses on preventing the death of beta-cells, the only cells in our body that make insulin. Type 1 diabetes occurs when the beta cells in the pancreas are destroyed by an autoimmune reaction.

Dr. Rubinstein's network is focusing on developing and testing strategies to prevent or block immune system rejection of pancreatic islet grafts that are transplanted to treat Type 1 diabetes. The strategies will focus both on the islet donor and the islet recipient.

Dr. Whiteside's network studies the cellular and molecular mechanisms related to renal complications of Type 1 diabetes.

- **The Canadian Neurotrauma Research Program.** This program funds basic and applied research and trains personnel in neurotrauma research. Partners with MRC in this initiative include the Rick Hansen Institute, the Canadian NeuroScience Partnership, the Regeneration Tour Society, the Alberta Paraplegic Foundation, the British Columbia Neurotrauma Initiative, the Manitoba Neurotrauma Initiative, the Ontario Neurotrauma Foundation, and the Newfoundland/Labrador Neurotrauma Committee.
- **The K.M. Hunter/MRC Doctoral Research Awards Program,** a partnership with the K.M. Hunter Charitable Foundation of Peterborough, Ontario. The partnership will support 31 students with exceptionally high potential for future research achievements in the areas of Alzheimer's disease, arthritis,

asthma, cancer, glaucoma, heart disease and stroke, multiple sclerosis, or schizophrenia.

- **The new Partnership Challenge Fund:** Through this program, launched in 1998, MRC has established partnerships with Canada's health charities to bring together federal investments and charitable donations to work in communities toward better health for Canadians. Since then, close to 200 new awards have been made in partnership with 33 organizations, including the Canadian Lung Association, the E.B. Baker Foundation for the Prevention of Blindness, the Heart and Stroke Foundation of Canada, and the Huntington Society of Canada. Their investment of \$3.4 million over two years will train about 80 people in all fields of health research, in accordance with the objectives of the partner organizations.

MRC partners: Governments

At the government level, MRC participates in partnerships to respond to priority health issues. These include:

- **The Canadian Health Services Research Foundation (CHSRF):** The CHSRF was established at the urging of the MRC to undertake research to improve the delivery of health care through Canada's health care system. Through its work, to which MRC contributes \$2 million per year, the CHSRF is

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helping to establish evidence-based decision-making as an integral part of doing business (see Chapter 4).

- **Canadian Strategy on HIV/AIDS:** MRC has been a key partner in the federal government's strategy on HIV/AIDS since 1993, through a collaborative initiative with the NHRDP. The collaboration supports research in a variety of areas, including population health, risk management, clinical management, and biomedical sciences.

AT THE UNIVERSITY OF WESTERN ONTARIO, RESEARCHERS ARE TRYING TO UNDERSTAND THE BIOLOGICAL MECHANISMS THAT CAUSE AIDS PATIENTS TO HAVE SIDE EFFECTS FROM DRUGS USED TO TREAT AIDS-RELATED ILLNESSES, SUCH AS PNEUMONIA.

- A joint Health Canada/MRC initiative worth more than \$18 million to fund research on **Hepatitis C**: The initiative, which will also leverage funds from other funders, will focus on research into preventing Hepatitis C, as well as research on quality-of-life issues and evaluations of existing treatments and patient care.
- **Genome Canada:** Following the completion of the Canadian Genome Analysis and Technology Program in 1997, the MRC created the Genome Task Force to prepare and implement a national, multi-partnered initiative, Genome Canada. The MRC

has provided \$5 million per year for five years to kick-start the initiative and attract other partners to realize the goal of a \$50-million-per-year-research program.

- **MRC Regional Partnerships Program (RPP):** This program provides up to \$22 million over a five-year period to researchers in the six provinces that have historically received the smallest portion of MRC funding – Manitoba, New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island, and Saskatchewan. The RPP matches funds invested at the institutional level, and, in Manitoba and Saskatchewan, funds invested by the provincial government. These are new funds for health research. The RPP supports a strategic planning process to establish research priorities and partnerships, build on local strengths and priority interests, and recruit promising and/or excellent scientists.

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MRC partners: Industry

The most significant of MRC's partnerships with industry began in 1993, with the creation of the **MRC/Rx&D Research Program** with Canada's 59 Research-Based Pharmaceutical Companies (formerly known as the Pharmaceutical Manufacturers' Association of Canada). This innovative program, originally called the MRC/PMAC Health Program, was the first of its kind, not only in Canada, but throughout the world. The strategic alliance increased cooperation and collaboration between academic researchers and the pharmaceutical industry, and created a greater understanding of the role of each in the cycle of innovation. The mutual respect that has developed between these two crucial partners in the health research enterprise has meant that the MRC/Rx&D Research Program has achieved results well beyond its financial support for health research.

Michael Hayden, of the University of British Columbia, is receiving funding from MRC and Merck Frosst through MRC/Rx&D for his mega-project in expanding our knowledge of molecular medicine, in particular the genetics of cell death (apoptosis) and neurodegeneration. His work will make important contributions to our understanding and treatment of conditions such as Huntington's Disease.

In its first five years, the MRC/Rx&D Research Program committed \$237 million in health research (\$205 million from Rx&D and \$32 million from MRC), funding more than 1,000 projects, including eight mega-projects, 50 clinical trials, and nearly 1,040 full-time equivalent positions for research assistants, technicians, graduate students, post-doctoral students, and other related positions in Canadian universities, hospitals, and research institutes. The program has led to the discovery that a new drug used to treat and prevent heart attacks and angina, **Hinudin**, is more effective at reducing deaths and further heart attacks than is the standard drug treatment. MRC/Rx&D has also funded four Clinical Research Chairs in Women's Health.





Chairs in Women's Health

Canada's first Chairs in Women's Health were created in partnership with Wyeth-Ayerst Canada Inc. to facilitate or lead multidisciplinary approaches to study critical issues in women's health, to stimulate research and develop standards for clinical excellence in the study of women's health issues, and to champion women's health as a field of medical research.

The first four holders of Chairs in Women's Health are:

- **Harriet McMillan** (McMaster University), studying the relationship between child maltreatment and psychiatric disorder in women across the life span
- **Hans Zingg** (McGill University), studying new approaches to the physiology and pathophysiology of parturition
- **Ruth McPherson** (University of Ottawa), studying prevention of cardiovascular disease in women
- **Bryan Richardson** (University of Western Ontario), studying fetal brain metabolism: biological and pathological development

Award and grant recipients under the program are all academic researchers, and all projects are peer-reviewed by the MRC, using MRC criteria. Projects must demonstrate scientific merit in order to be funded, with industry providing 80 per cent of funding and the MRC providing 20 per cent. All funds are directed to and expended under the direction of scientists in academic health centres in Canada. The program encompasses training, salary support, basic research, and clinical research.



This partnership has resulted in many innovative studies, including research into pain in newborn babies and into gene function according to their location. The program has also funded clinical trials to test promising new treatments for diseases such as Alzheimer's disease, Hepatitis C, and HIV.

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- **Ruth McPherson** (University of Ottawa), studying prevention of cardiovascular disease in women
- **Bryan Richardson** (University of Western Ontario), studying fetal brain metabolism: biological and pathological development

Award and grant recipients under the program are all academic researchers, and all projects are peer-reviewed by the MRC, using MRC criteria. Projects must demonstrate scientific merit in order to be funded, with industry providing 80 per cent of funding and the MRC providing 20 per cent. All funds are directed to and expended under the direction of scientists in academic health centres in Canada. The program encompasses training, salary support, basic research, and clinical research.

The AstraZeneca Research Award program is a multi-million initiative operated through Rx&D. The award is designed to fund two-year basic research projects by young scientists across Canada. Nicola Jones was a 1997 award winner. Today, she is an assistant professor at the Department of Pediatrics at the University of Toronto and a clinical scientist at the Hospital for Sick Children.

This partnership has resulted in many innovative studies, including research into pain in newborn babies and into gene function according to their location. The program has also funded clinical trials to test promising new treatments for diseases such as Alzheimer's disease, Hepatitis C, and HIV.

Phase II of the program was launched this year, with both parties pledging to significantly exceed Phase I funding. Among the new initiatives to be undertaken are University-Industry Research Chairs with funding up to \$140,000 per year plus operating funds. Phase II of the MRC/Rx&D Research Program will help to create a viable research environment to attract and retain the best scientists in Canada and will help to stimulate and increase investment in Canada by both the pharmaceutical and biomedical industries. It is an excellent example of the kind of innovative health research partnerships that benefit both the participants and the people of Canada.

Other MRC-industry partnerships include:

- The **University-Industry Program**, which has provided an opportunity for researchers to work in closer cooperation with non-Rx&D companies since 1987.
- The **Canadian Medical Discoveries Fund (CMDf)**, a venture capital fund to assist researchers in commercializing their research discoveries. CMDf, which resulted from an MRC vision, is an important venture capital investor in Canada's life sciences sector (see Chapter 4).
- The **Life Science Research Investment Initiative**, a strategic partnership supported by the MRC, Investment Partnerships Canada, and the Life Sciences Branch of Industry Canada. Its role is to promote excellent Canadian medical science to companies in the United States, Europe, and Japan.
- **Networks of Centres of Excellence (NCEs)**, unique partnerships among industry, universities, and government that bring together excellent research and industrial expertise. The MRC contributes financial support to the **seven Health and Biotechnology NCEs**: the **Canadian Arthritis Network**, the **Canadian Bacterial Diseases Network**, the **Canadian Genetic Diseases Network**, the **Protein Engineering Network**, **HEALNet** — Health Evidence Application and

Preventing premature death

The MRC/Rx&D Heart Outcomes Prevention Evaluation Study (HOPE Study), funded in partnership with Hoechst Marion Roussel Canada and chaired by Dr. Salim Yusuf, found that using the anti-hypertensive drug ramipril substantially improved survival after heart attack and lowered the risk of subsequent heart attacks. **Application of these findings could prevent one million premature deaths, heart attacks, and strokes each year.**



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Linkage Network, the Canadian Stroke Network, and the Canadian Network for Vaccines and Immunotherapeutics of Cancer and Chronic Viral Diseases (CANVAC).

International partnerships

It is said that research knows no boundaries. Nonetheless, national comparisons are inevitable. Canada accounts for only four per cent of the world's health research, but the excellence of Canadian research, and the international reputation for excellence of our peer review system, make Canada a desired partner in international collaborations. In turn, Canada gains access to more research funding, which creates new training opportunities, and reinforces the strengths of domestic health sciences research.

The MRC's international partnerships include:

- The **International Human Frontier Science Program (HFSP)**: A partnership among Japan, the United States, the United Kingdom, the European Commission, France, Germany, Italy, and Switzerland, as well as Canada, to support international collaborative research and research training in the neurosciences and molecular biology. The program also supports international scientific meetings to explore rapidly developing fields of research. Canada contributes

approximately \$700,000 each year (half each from MRC and NRC), while Canadian scientists obtain \$1-2 million in research funding from HFSP.



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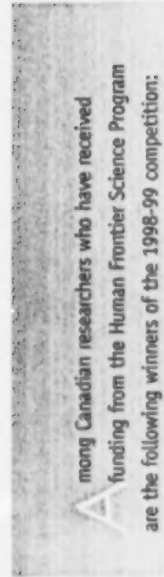
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Among Canadian researchers who have received funding from the Human Frontier Science Program are the following winners of the 1998-99 competition:

- **John Randall Flanagan** (Queen's University) and **John F. Kalaska** (Université de Montréal), for their study of internal models for multiple tasks in sensorimotor control
- **Alan Kingstone** (University of Alberta) and **Patricia Ann McMullen** (Dalhousie University), for their study of subcortical mechanisms of vision
- **Stephen W. Michnick** (Université de Montréal), studying TGF β signal transduction from cell surface to nucleus
- **Serguei Steinberg** (Université de Montréal), for his study of the importation of RNA into mitochondria: mechanism and biomedical significance

- **The Japan Canada Neuroscience Partnership:** This partnership is designed to facilitate world-class research through collaboration between Canadian and Japanese neuroscientists. The partnership focuses on developing contacts between the two countries and on developing programs to facilitate movement of trainees between the two countries.
- **Canada Singapore Exchange Program:** The MRC and the Institute of Molecular and Cell Biology of Singapore have an agreement to support research and development activities in both countries, with a focus on cancer, infectious diseases, and the development of cutting-edge vaccines.
- **The Burroughs Wellcome Student Research Award:** This partnership between the MRC and the Burroughs Wellcome Fund supports in the areas of medicine, dentistry, pharmacy, and the health sciences. The Burroughs Wellcome Fund is an independent, private foundation based in North Carolina that supports research and other scientific and educational activity in the medical sciences.





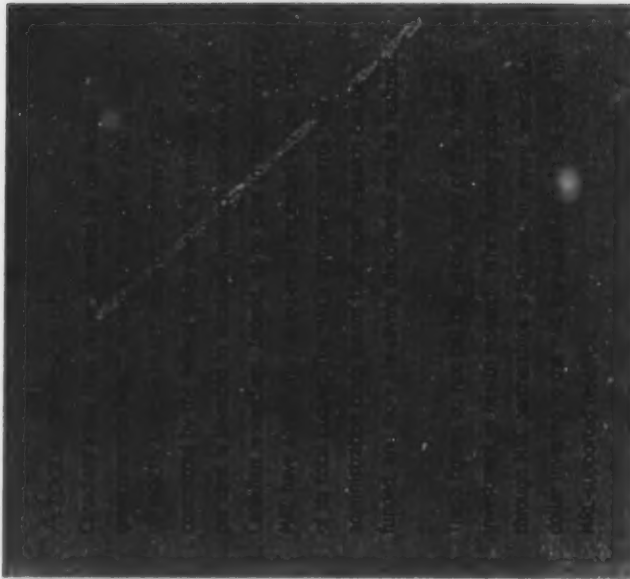
Chapter 4: Health Research: ~ Strengthening the Health Care System, Strengthening the Economy

HEALTH RESEARCH HAS TRADITIONALLY BEEN SEEN AND UNDERSTOOD AS A KEY FACTOR IN IMPROVING THE HEALTH AND WELL-BEING OF PEOPLE. HEALTH RESEARCH HAS HELPED TO PREVENT DISEASE AMONG PEOPLE AND TO TREAT IT MORE SUCCESSFULLY WHEN IT OCCURS.

Over the past decade, decision-makers have come to understand the role health research can play in two other important areas of Canadian life. Health research has an important role to play in ensuring that our health-care system operates efficiently and cost-effectively to meet the health needs of Canadians. It also serves as a catalyst for economic growth.

Canadians understand this. Recent public opinion research has found that 79 per cent of Canadians believe funding for health research should be increased in order to bring about improvements in population health and enable Canada to reap the economic benefits of sharing its discoveries with the rest of the world.

As part of the redefinition of the role of MRC that took place in the first half of the 1990s, health services research and realizing the economic benefits of Canadian research discoveries have both become important foci of MRC activity.



Improving the health of the health care system

Our health care system is prized by Canadians. It is a national symbol that, in the minds of Canadians, sets us apart from the United States, and one of which Canadians can justly be proud. Yet, over the past several years, Canadians, faced by long waits for treatment, bulging emergency rooms, and a perceived lack of resources, have felt growing concern about the ability of our health care system to continue to meet our health needs and those of our families in the future.

As Canada works to renew its health system, it is clear that research must be at the heart of the renewal process. Investments in health research enable us to determine the elements that contribute most to the health of Canadians. Research also provides a solid base of evidence for public health policies, and for the funding and management of health services.

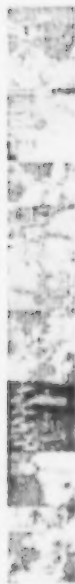
Health care in Canada is an \$85-billion per year industry. Until recently, however, there has been little evidence on which to evaluate how effective the health care system has been at maintaining and improving the health of Canadians, and little evidence of whether the money spent has been spent wisely and well. In fact, some have questioned the effectiveness of many

interventions in the health care system and whether expensive forms of intervention are favoured over less costly, but equally effective, alternatives.

Increasingly, there is more interest in the need for research on outcomes. Conducting a more rigorous evaluation of everything we do, from therapies to training systems and research methods, can generate important new efficiencies while revealing new opportunities. In the words of the National Forum on Health, "applying the best available evidence in the decision making process does not guarantee good decisions or outcomes, but it does improve the odds of achieving both."

Health Care Services Research

- A study by Paul Hébert of more than 800 patients admitted to intensive care at the Ottawa General Hospital demonstrated that it was possible to transfuse less blood and obtain similar or even better results. This study marked the first time that traditional blood transfusion practices had been called into question, and led directly to a more efficient use of limited blood supplies.
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A focus on research

Canadians know that money invested by the federal government in health research through the MRC is spent on exactly that — health research. For every dollar committed by the federal government, a minimum of 95 per cent is invested in excellent research carried out by Canadian researchers. Indeed, at no time in the history of MRC have administrative expenses exceeded 4.7 per cent of its total budget. The MRC's stringent control over administration costs means that more research can be funded, and more life-saving discoveries may be realized.

These figures do not tell the whole story of the federal investment in health research. When funding acquired through MRC partnerships is factored in, every federal tax dollar invested in the MRC translates into \$1.36 spent on MRC-supported research.

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- **Morris Barer**, of the University of British Columbia, is assessing the reliability and validity of waiting list size and time data for selected surgical procedures in British Columbia. Access to waiting list data that are obtained uniformly at different sites and times is essential in determining how well the health care system is providing care to Canadians.
- **Claude Sicotte**, of the Université de Montréal, is investigating how physicians incorporate telemedicine into their clinical practice. Given the large potential of telemedicine for delivering improved quality of care to remote communities at low cost, it is vital to discover how it can be most effectively used by physicians and other health care providers at both the central and the remote site.
- **Susan Jaglal**, of Toronto's Sunnybrook Hospital, is determining the effectiveness of a program that allows elderly patients with hip fractures to be discharged earlier

from hospital to begin rehabilitation in the comfort of their own homes. Besides reducing costs, this program has the potential to improve the quality of life for these Canadians while they recover from their injuries.

Since 1992, MRC has progressively increased funding for health services research. In 1999–2000, MRC invested \$18.3 million in health research (including population health and psychosocial and behavioural research, as well as health services research). Partner contributions brought the total to \$20.2 million — the largest such investment of any federal research organization.

These funds are invested in different programs, in many of which MRC plays a leading role. For instance, primarily as a result of MRC's effort, the federal government established the Canadian Health Services Research Foundation (CHSRF) in its 1996 budget. Its initial endowment of \$65 million was increased to \$100 million in 1999. As a founding partner in CHSRF, MRC contributes \$10 million over five years, and is represented on the foundation's board of directors.

"The mission of the Canadian Health Services Research Foundation is to sponsor and promote applied health systems research, to enhance its quality and relevance, and to facilitate its use in evidence-based decision making by policy makers and health systems managers."

CHSRF funds research related to health systems to assist policy-makers in evidence-based decision making. All research proposals funded by CHSRF must meet standards of excellence as judged through the peer review process.

CHSRF also administers the NURSE Fund, a \$25 million fund announced in the 1999 federal budget to finance research on issues related to nursing and the delivery of health care. The fund is being used to create Nursing Research Chairs, to provide training to increase Canada's capacity in nursing research, to fund specific research projects, and to disseminate research findings to nurses.

MRC also provides financial support to HEALNet (the Health Evidence Application and Linkage Network), a Network of Centres of Excellence that focuses on enhancing the use of information in health-care decision making. The Network received \$1.8 million in 1999-2000. MRC also invests in health services research through

the Genomics Research Program, the Canadian Breast Cancer Research Initiative, and the HIV/AIDS program (see Chapter 3).

Canadians value the creativity and imagination that scientists bring to their work. Now, through bodies such as CHSRF and HEALNet, we can be equally creative and imaginative about how we organize funding of our health care system to deliver services to Canadians in a way that meets their needs and priorities.

Health research: A catalyst for economic growth

Did you know?

With 1,100 employees, the Centre de recherche du Centre Hospitalier de l'Université Laval is the second largest employer in Quebec City, after the provincial government.

Canada's record of excellence in health research has improved the health of people around the world. But its benefits do not stop there. Canadian health research is also a powerful engine of economic growth and a growing source of high-quality jobs, and will continue to be so in the knowledge-based economy of the 21st century.

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The life sciences sector of the Canadian economy grew 41 per cent between 1990 and 1997. It now accounts for 86,000 jobs in Canada — many more than its closest competitor, the aerospace industry, at 64,000 jobs. And by 2003, life sciences are expected to account for 136,500 jobs — an increase of more than 50 per cent in just four years. Already, there are more than 100 publicly listed Canadian companies in the life sciences, with a market value of close to \$15 billion. In 1996, the five MRC-supported NCEs announced the creation of 23 new spin-off companies.

Value for Money

Research has an impact on productivity, usually through the new products or processes that result from new knowledge and/or through reductions in the cost of supplying an existing service such as health care.

Economists assess the value of this impact by calculating the returns delivered by the research investment. Specialists in R&D assessment agree that private investment in R&D provides an average 20 to 30 per cent annual rate of return and a much greater return to society overall. Social rates of return from research average about 50 per cent.

The potential for growth in this area is huge. As of January 1, 1999, Canadian biopharmaceutical companies had 311 products under development — 311 products that have the potential to improve the health and well-being of Canadians, to provide high-quality employment to many thousands of people and contribute to Canada's economic growth, and to help to make Canada internationally competitive in the 21st century.

One of the most important developments of the 1990s has been the increasing ability to commercialize these research discoveries here in Canada. The Canadian Medical Discoveries Fund was created in 1994, in large part due to the commitment and efforts of London's Dr. Cal Stiller. This venture capital fund has raised more than \$250 million from nearly 60,000 Canadian investors, making it one of the largest investors in the life sciences in Canada. To date, it has directly invested \$178 million in close to 40 Canadian companies to bring new technology, health care products, medical devices, and pharmaceuticals to market — creating more than 500 jobs in the process.



THE MEDICAL RESEARCH COUNCIL OF CANADA



Its vaccine arm, Biovac, is the only vaccine manufacturing plant in Canada, manufacturing influenza and meningitis vaccines.

WorldHeart Corporation of Ottawa, Ontario is just one example of how research support from the MRC, health charities and others helped health researchers at the Ottawa Heart Institute achieve world prominence in the design of devices to assist ailing hearts. In 1989, a multidisciplinary team of health professionals and engineers, led by Dr. Wilbert Keon and Dr. Tofy Mussivand, began the development of what is essentially a fully implantable artificial heart. Their work was based on basic research in the functioning of

heart muscles, nerves and vessels, the performance of cardiac tissues under the stress of surgery, and factors affecting the successful acceptance of implants.

In 1996, WorldHeart Corporation acquired worldwide rights to the device developed by Drs. Keon and Mussivand and their team at the Ottawa Heart Institute. WorldHeart currently has more than 70 employees and is publicly traded. The commercial potential of the ventricular assist device in the global market is significant.

Academic research spawns commercial success

- Winnipeg's Allan Mutch and Gerry Lafave are partners with the University of Manitoba and the Crocus Investment Fund in Biovar Life Support Inc., which is bringing to market their invention of devices to help patients undergoing heart bypass surgery.
- Through Apoptogen, Ottawa's Bob Korneluk and Alex McKenzie are using the knowledge generated by their academic research to provide new hope to cancer and stroke victims — and using the profits to support their further research and to train new young scientists.

In the 1980s, Francisco Bellini received a small government grant to explore an idea.

Today, the drug Dr. Bellini developed, 3TC, has dramatically reduced AIDS deaths worldwide, and BioChem Pharma, the company he started, is one of the largest biotechnology companies in the world, with a capitalization of more than \$4 billion and more than 1,500 employees. The company also discovered and manufactures Zeffix, a once-daily oral treatment for chronic Hepatitis B.

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UBC's Bob Hancock focuses his research on cationic peptides, which act rapidly against all types of bacteria, including the antibiotic-resistant superbugs. Vancouver's Micrologix Biotech is testing cationic peptides for treating acute acne and preventing infections from catheterization. Results of a preliminary clinical trial indicate that its lead antibiotic peptide, MRL226, is safe and well-tolerated, eliminates 99.9 per cent of bacteria commonly found on the skin, and prevents bacterial growth on catheters. As a result of its work in this area, the company has grown to more than 40 employees, has raised \$30 million in capital, and is traded publicly.

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- **Quadra Logic Technologies**, in Vancouver, manufactures photofrin, an anti-cancer drug that works by sensitizing cancer cells so that they can be destroyed by a safe form of radiation. Julia Levy, one of the company's founders, and today its Senior Vice President and Chief Scientific Officer, was a co-discoverer of the new treatment.

A LEGACY OF EXCELLENCE

- **DiagnoCure**, a Quebec City biotech company, has developed a highly accurate test that can detect early signs of prostate cancer, improving the chances of successfully treating the disease. Developed by Yves Fradet, the test spots a genetic "marker" for prostate cancer in urine, avoiding the need for painful biopsies.

As we move into the new millennium, it is clear that health research will continue to be a catalyst for Canada's economic growth and international competitiveness, while helping to maintain and improve the health care system that is such a source of national pride to Canadians.



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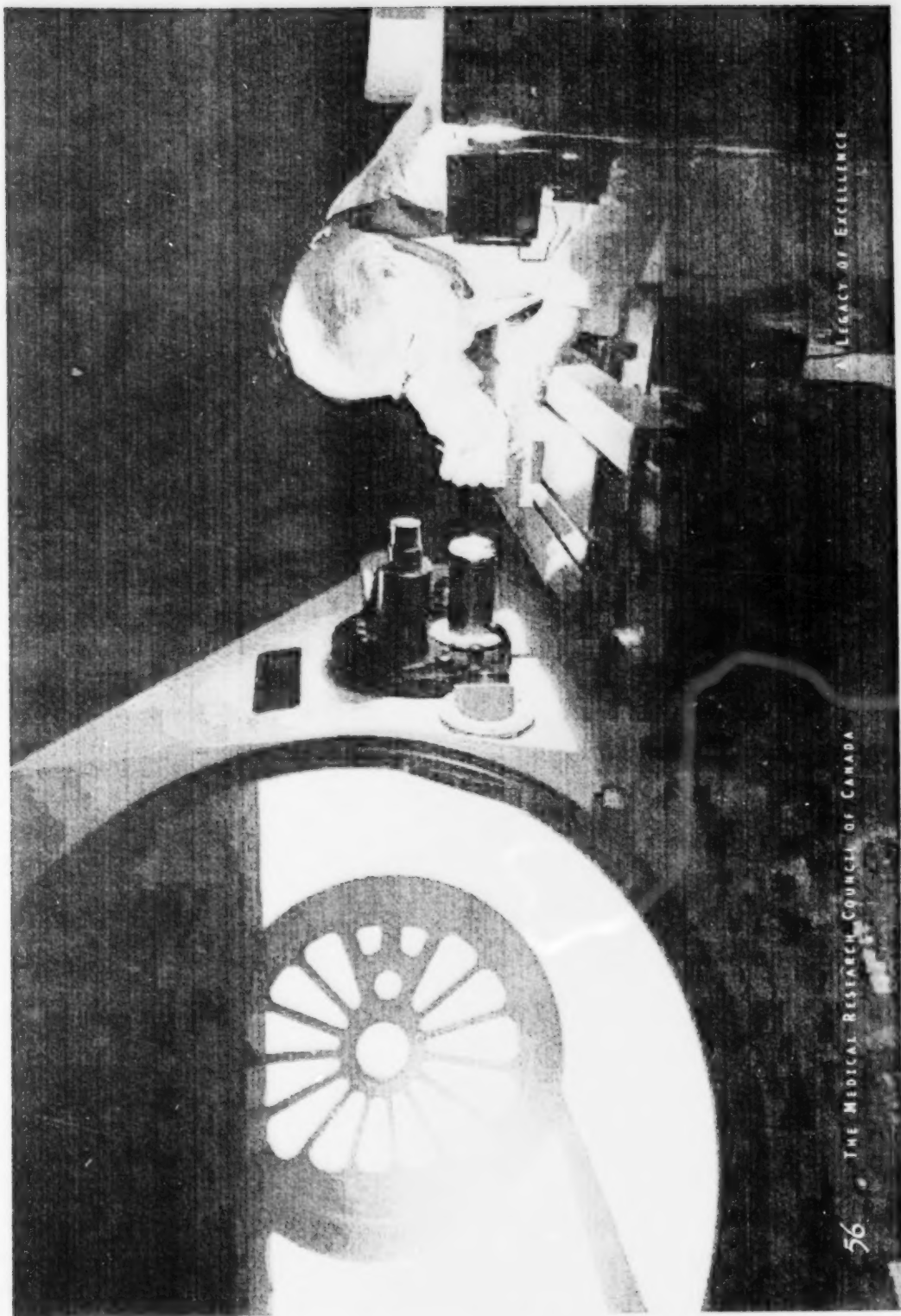
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A LEGACY OF EXCELLENCE

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Chapter 5: Creating and Sustaining Excellence for Tomorrow

THE STARS OF MEDICAL RESEARCH ARE NOT CREATED OVERNIGHT. THEY ARE THE PRODUCT OF SUSTAINED SUPPORT AS THEY TRAIN AND BUILD THEIR CAREERS AND REPUTATIONS, FROM STUDENT DAYS, THROUGH ADVANCED POST-DOCTORAL WORK, TO INCREASING RESEARCH INDEPENDENCE AND LEADERSHIP OF THEIR OWN LABORATORIES, IN TURN PROVIDING THE MENTORSHIP AND TRAINING TO CREATE THE NEXT GENERATION OF HEALTH RESEARCHERS.

Over the past 40 years, MRC funding has provided the support that has enabled the excellent researchers of today to reach their full potential, and the researchers of tomorrow to develop their skills and insights.

The Canadian researchers profiled here are but a few of those who will be at the forefront of research discoveries in the new millennium.

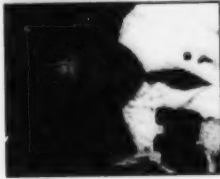
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Online guidance for today's young scientists

Making the transition from a student to an independent researcher can be a difficult journey. Now, young researchers can get help from *Science's Next Wave*, an online publication that provides information about scientific training, career development, and the job market in all research sectors.

MRC has purchased the Canadian site license for *Science's Next Wave*, to provide young researchers with free and unlimited access to this educational tool.

The next generation of Canadian research pioneers can find *Science's Next Wave* at <http://nextwave-ca.sciencemag.org/>.

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François Auger, professor in the Department of Surgery of l'Université Laval, never wanted to limit his options; while in university, he studied both science and the humanities, and even contemplated a career in architecture. But once he started medical school, Dr. Auger realized he could make a greater impact in life as a scientist. "It's easier to be a

physician," he says, "and do some architecture on the side." Tissue engineering was a revolutionary concept when Dr. Auger founded the Laboratory for Experimental Organogenesis (LOEX) at l'Université Laval in 1985. Under his direction, he has seen LOEX grow from a sketchy dream into the first research group in Canada dedicated to the reconstruction of human tissues by human cell culture. He has grown complete skin, blood vessels, ligaments, cartilage, bronchi, and corneas in his university laboratory, and helped people with severe burns to survive. By designing novel ways to save Canadian lives, Dr. Auger has remained an architect at heart, while making science his primary activity. "I'm in the business of hope," Dr. Auger says. "This gives hope to things that seemed unrepairable over 25 years ago."

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In high school, **Susan P.C. Cole** had a passion for English — until her final year of high school, when she landed a laboratory research job. Today, 28 years later, Dr. Cole, a professor in the Cancer Research Laboratories at Queen's University, is a trail-blazing Senior Career Scientist at the Kingston Regional Cancer Centre. How did she get there? "Victor Ling's

work inspired me," she says. In the late 1970s, Dr. Ling, now a senior researcher at the B.C. Cancer Control Agency, discovered that a protein found on the surface of drug-resistant cancer cells, called P-glycoproteins (P-gp), could pump drugs out of the cells. Dr. Ling's work revolutionized cancer research, because it forced scientists to look at the genetic make-up of drug-sensitive and drug-resistant cancerous cells. Once P-gp was analysed, it was believed that new treatments could be developed to bypass the drug resistance and combat cancer. In 1992, Dr. Cole added a new layer to Dr. Ling's work when she stumbled on another protein in cancerous cells that caused drug resistance. Multidrug resistance protein (MRP), which Dr. Cole co-discovered with Roger Deeley, shook the research world. "Sometimes we're referred to as the mother and father of MRP," she jests. Since her co-discovery of the protein, other variants of the MRP-family have been



A LEGACY OF EXCELLENCE

discovered by other investigators around the world. Along with Dr. Deeley and her research team, Dr. Cole wants to biochemically dissect MRP and find out more about the function of MRP in normal cells so that more effective cancer treatments can be developed. As for her love of English, it's been put to good use in writing funding applications and more than 127 research papers. Dr. Cole's achievements are a model for Canadian women, especially those who don't have the itch for science until they feel the test tube in their hands.

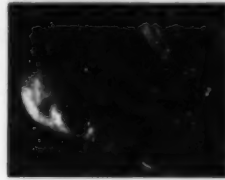
- As a practising veterinarian, **Alastair Cribb** was intrigued by species-specific drug responses. Now he wants to know what genetic quirks make a relatively safe drug dangerous in some human patients. An MRC Scholar, Dr. Cribb holds doctoral degrees from the University of Saskatchewan and the University of Toronto.



He has worked as a senior research pharmacologist with Merck Research Laboratories in West Point, Pennsylvania. Today, Dr. Cribb is a professor of clinical pharmacology and director of the Laboratory for Comparative Pharmacogenetics at the University of Prince Edward Island, as well as being an adjunct professor in the Department of Pharmacology at Dalhousie University.

So why would this gifted researcher settle in Charlottetown, PEI, where scientific funding can be scarce? "There was a lot of opportunity for me to build something here," Dr. Cribb says. What he's building in Charlottetown could save thousands of Canadian lives. Dr. Cribb specializes in molecular toxicology. He analyzes effects of drugs on a molecular level, to understand why humans and animals experience adverse side effects — anything from skin rashes to fatalities. "I hope to make drugs safer," Dr. Cribb says. Working with sulfonamides, anti-convulsants, and anti-inflammatory drugs, as well as estrogen in breast cancer, Dr. Cribb and his research team at UPEI are attempting to unravel the genetic differences between individuals that influence susceptibility to drug and chemical toxicity. He looks forward to the day when people will hold "genetic credit cards" that let physicians know the safest and most effective drugs for each patient. Until that day comes, Dr. Cribb enjoys teaching his students the research keys needed to unlock the genetic mysteries of adverse drug reactions. "If you get involved in research and in training," he says, "you get other people involved, and you can leave a greater legacy."

- As a boy, **B. Brett Finlay**, now a professor in



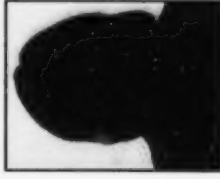
biotechnology, biochemistry and molecular biology and a member of the Department of Microbiology and Immunology at the

University of British Columbia, thought he would become a paleontologist. Much of this boyish enthusiasm had to do with digging in dirt and searching for dinosaur eggs, but it

also had to do with discoveries. "I loved figuring out how things work," Dr. Finlay says. His enthusiasm for discovery remains undiminished. Along with his research team at UBC, Dr. Finlay has made a career out of trying to unlock the mysteries of bacterial pathogens known as *E. coli*, *Salmonella* and *Listeria*. He wants to understand how these three organisms attack intestinal cells, causing illness and sometimes death. Dr. Finlay's research could lead to novel vaccines, diagnostics, and therapeutics to control these bacterial infections. Thousands of students from around the world learned about his groundbreaking research when he became the first Canadian invited by the Howard Hughes Memorial Institute (HHMI) to give a 'virtual' Holiday Lecture on science on the World Wide Web. With this prestigious honour under his belt, Dr. Finlay remains modest — and even retains a sense of

humour. "I was completely flabbergasted when (HHMI) asked me to do this," he says, adding that he threw a few "eh's" into his Holiday Lecture to make it more Canadian.

- **Marilyn Ford-Gilboe** is a nurse with a Ph.D. who finds her inspiration in the participants in her



research. Dr. Ford-Gilboe, an associate professor in the School of Nursing at the University of Western Ontario, believes that the family is critical in shaping how we learn to care for our health and to nurture each other, and that this process is affected by the challenges that families face in their everyday lives.

Together with colleagues from the University of Western Ontario and the University of New Brunswick, Dr. Ford-Gilboe is exploring how single mothers and their children learn to care for themselves and to create a new family life after leaving abusive partners. The research team is conducting in-depth interviews with 40 to 50 families. By constantly comparing the stories told by these families, the team is developing a "grounded" theory that explains how these families move beyond their experiences of abuse to deal with an uncertain future while nurturing each other and developing to their full potentials. Her

data come from interviews with single mothers and their children. "I'm in awe of the strength of these women," Dr. Ford-Gilboe says. Single mothers and their children, she theorizes, have extraordinary adaptive qualities needed to meet the challenges of a new life. At the same time, the support of family friends, professionals, and "the system" is vital in helping them move ahead. For Dr. Ford-Gilboe and her research team, the study is a continuous learning experience. "You keep refining your ideas as you go to new participants," she says. These new ideas about how single-parent families learn to care for themselves and the types of supports they need to do this, may help improve the lives of many single Canadian mothers and their children.

- To her colleagues, **C. May Griffith** is a respected, Harvard-educated research scientist, with a bachelor's degree in zoology and human biology, a master's degree in zoology, and a Ph.D in anatomy. Few people are aware that she also has earned a master's degree in business administration — a "fallback" plan she's unlikely to need. Dr. Griffith made headlines



when she and her research team at the University of Ottawa Eye Institute constructed an artificial cornea (the

transparent sheath that covers the eye and protects it from the surrounding environment). As people age, their corneas tend to deteriorate. Initially, Dr. Griffith was studying human corneal deterioration, for which she had to grow corneal-like tissue. Her success inspired the idea of creating an artificial substitute. As described in *Science*, Dr. Griffith's artificial cornea is constructed of three layers of cells and looks a lot like a contact lens. The artificial cornea still needs extensive testing, but Dr. Griffith's discovery could lead to human transplants in the not-too-distant future and may eliminate the need for live animals in testing the toxicity of new drugs and other potentially irritating substances for the eye. When she talks about her work, Dr. Griffith, a selfless and enthusiastic researcher, is quick and to the point: "I want to make a difference." Thanks to her, the vision-impaired may someday be able to appreciate the significant difference she has already made.



- Genetics first caught the interest of **Bartha Maria**



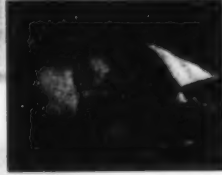
Knoppers in 1987. Dr. Knoppers, a highly respected lawyer whose specialties included human reproduction, wanted to understand the international and ethical implications of genetics and biotechnology. At that time, human genetics was a relatively new field.

With the encouragement of former MRC

president Pierre Bois, Dr. Knoppers won a research grant that sent her on a novel research journey. In 1990, Dr. Knoppers produced a paper, "Human Dignity And Genetic Heritage", which has led her to genomes. Genomes are a collection of genes in living organisms that provide a blueprint toward their creation. DNA, or deoxyribonucleic acid, is the 'language' for this instruction. Genomic variations help researchers determine the construction of everything from a tree to a worm. Dr. Knoppers, currently a full professor in the faculty of law at l'Université de Montréal, examines the ethical implications of genomics. "Is the human being just another form of living matter?" she asks. This is an important question, because the Canadian government invests a lot of money in genomics, in areas ranging from human beings to forestry. Dr. Knoppers is currently undertaking an MRC-funded critical review of the ethical guidelines used for the storage of

biological materials in genetic research. In a short while, she expects to have drafted a model consent form for subjects undergoing human genetic research. Dr. Knoppers' ultimate goal is to integrate an internationally accepted, ethical model for genetic research, and to help calm the debate about the so-called dangers of genomics. "I presume that people are morally responsible," she says, "and that people have the desire to know the facts about something."

- **Fernand Labrie**, the renowned endocrinologist from l'Université Laval, enjoys scientific challenges. "I've always been interested in the quantitative aspects



of things," he says. As a child, Dr. Labrie devoured science and mathematics books and participated in science fairs. As an adult,

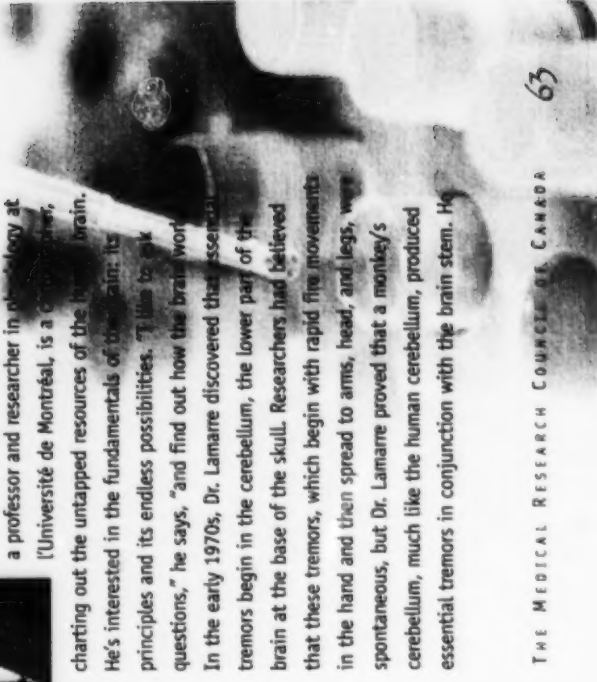
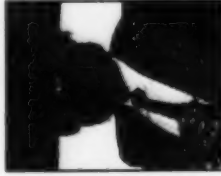
Dr. Labrie has revolutionized endocrinology by introducing concepts that have changed the way people think about hormones and how hormone-sensitive cancers such as breast and prostate cancers are treated.

Endocrinology is the study of hormones, which are secreted primarily from glands, and their subsequent effect on other organs. In 1969, while in Cambridge, England, Dr. Labrie purified hemoglobin messenger RNA, the first

messenger RNA of mammalian origin. In 1972, he founded the Molecular Endocrinology Research Centre at l'Université Laval. In 1973, the MRC recognized Dr. Labrie's research by funding the first MRC Group in endocrinology under his direction. Since then, he and the MRC Group have discovered and developed the use of LHRH agonists to achieve highly efficient but reversible chemical castration in men. This treatment is now used in more than 90 per cent of patients receiving hormonal therapy for prostate cancer in North America and Europe. With his MRC Group, he discovered combined androgen blockade, a treatment that blocks both testicular and adrenal sources of male hormones at the start of treatment. This first treatment shown to prolong life in men with prostate cancer has become standard worldwide. He and his Group also developed a pure anti-estrogen that may help to prevent breast and uterine cancer, as well as bone loss and cardiovascular disease in post-menopausal women. Dr. Labrie is currently investigating the area of *intracrinology* — a new field of endocrinology developed by his Group that describes the mechanisms whereby sex hormones are produced in large proportion in peripheral tissues of the human body. Understanding the genetic coding and control of expression of enzymes that transform inactive to active hormones, which can lead to the development

and/or more rapid growth of malignant tumours, could enable Dr. Labrie to design novel treatments to fight breast and prostate cancer. "Decreasing suffering and saving lives," he says, "that's the driving force in my life."

- More than 50 years ago, Yves Lamarre's younger sister died from a rare spinal cord disease. Her death was devastating — but also his inspiration. "Certainly the reason I got into the central nervous system was the death of my little sister," he says. Today, Dr. Lamarre, a professor and researcher in physiology at l'Université de Montréal, is a pioneer, charting out the untapped resources of the human brain. He's interested in the fundamentals of the brain: its principles and its endless possibilities. "I like to ask questions," he says, "and find out how the brain works." In the early 1970s, Dr. Lamarre discovered that essential tremors begin in the cerebellum, the lower part of the brain at the base of the skull. Researchers had believed that these tremors, which begin with rapid fine movements in the hand and then spread to arms, head, and legs, were spontaneous, but Dr. Lamarre proved that a monkey's cerebellum, much like the human cerebellum, produced essential tremors in conjunction with the brain stem. He



has also helped one woman who, 20 years before, had lost her basic motor skills in the space of about a week due to an inexplicable disease, to learn to sign her name on a cheque. Dr. Lamarre helped her train her brain to use her eyes. In other words, if she can see the paper, she can sign her name. The process took a couple of years, but succeeded without the use of drug treatments. "The more we know about the brain," Dr. Lamarre says, "some way, somehow, we can treat the disease." Dr. Lamarre's current research focus is to show that attitudes and concentration, once thought to be reserved for the upper lobes of the brain, are controlled in some way by the cerebellum. As a neurological cartographer, Dr. Lamarre is a scientist who thrives in uncharted research waters.

- As a high school student in Hong Kong, **Patrick Lee** considered two career paths: the arts or the sciences. He chose science. As a highly respected virologist and cancer biologist at the University of Calgary, Dr. Lee has championed the development of reovirus as a potential treatment for cancer. Reovirus, like all viruses, self-propagates and multiplies when it attaches itself to a host cell. With ordinary viruses, this can cause sickness due to infection. Reovirus,



though, kills cancerous host cells and leaves normal, healthy cells alone. Using reovirus is a novel approach to treating cancer, and Dr. Lee says that he and his team of scientists at the Cancer and Biology Research Group at the University of Calgary stumbled upon it quite accidentally. "Sometimes," he says, "major breakthroughs come from nowhere." Dr. Lee started studying the cell structure of reovirus in 1978, when he was completing his Ph.D. in biochemistry at the University of Alberta. In 1998, Dr. Lee first injected reovirus into mice with cancerous tumours, and discovered that the tumours almost totally regressed. As a result of Dr. Lee's discovery, human trials of reovirus in the form of a drug called Reosyn, will start in May 2000 at the Tom Baker Cancer Centre in Calgary. If the trials work, Reosyn could be used to fight malignant breast, lung or even neck tumours. It is uncertain if this virus will prove to be the magic bullet that kills the cancer demon, but Dr. Lee sees a lot of hope in his discovery. Canadians can be thankful that Dr. Lee's curiosity led him to a career in science.

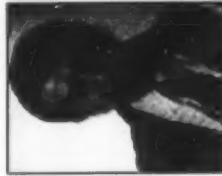
- As a clinical nurse in the 1980s, **Sandra M. LeFort** helped 'chronic pain' patients who suffered from back aches or sleep deprivation. She became tired of seeing other people suffer, though, and decided to develop a solution. In 1990, Dr. LeFort went back to school and earned a Ph.D. in Nursing at McGill University.



Inspired by the work of Dr. Kate Lorig, and her program to help people cope with arthritis in the United States, Mrs. LeFort wrote her doctoral thesis on chronic pain. "I was interested in a community-based program that would be accessible in all areas of Canada," she says. In 1997, her doctoral dream came true. Using a case study of 110 people from St. John's, Newfoundland, Dr. LeFort tested her "Chronic Pain Self-Management Program". Half the group participated in the 12-hour self-help program of exercise and time management, while the control group did not. In 1999, the study's results showed that those who followed Dr. LeFort's program improved their quality of life. Based on that research success, Dr. LeFort, currently an associate professor in the School of Nursing at Memorial University, won an MRC grant to develop a second study that includes 286 people. Chronic pain patients from Newfoundland and Ontario have been chosen to test whether the program works in large cities

as well as it does in small towns. The program will be administered by the Veterans Affairs Health Services Canada (VON Canada), a federal government organization. national health care organization. Dr. LeFort is a nurse, that has been working for 20 years in various homes, local community health centres, and hospitals for 100 years. For the past 10 years, Dr. LeFort has been teaching these nurses how to help their patients with their 12-hour program and help chronic pain sufferers help themselves. Dr. LeFort is looking beyond the boundaries of this study. "I'd like to see the VON pick up this program and disseminate this across Canada," she says.

- It started with Isaac Newton. **Victor Ling**, now Vice-President of Research at the B.C. Cancer Agency and the B.C. Cancer Research Centre, read about Newton's theory of gravity, while he was still in public school. But it wasn't the falling apple that intrigued Dr. Ling, it was the questions that Newton asked. "He saw an apple fall," Dr. Ling says. "He questioned it. Why does it fall down? Why doesn't it fall sideways?" These kinds of intellectual questions have inspired Dr. Ling throughout his research career. And it's thanks to his curiosity that the world now knows about a

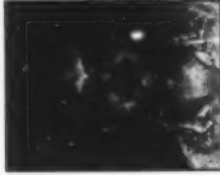


protein called P-glycoprotein. In the early 1980s, while studying how cancer cells mutated and multiplied, Dr. Ling discovered that some cells resisted anti-cancer medication. At that time, he was a researcher at Toronto's Princess Margaret Hospital. "If these cells were able to be resistant to anti-cancer drugs," Dr. Ling realized, "wouldn't this be important to cancer patients?" Inspired by his own research question, Dr. Ling went down to the hospital pharmacy, bought a number of anti-cancer drugs, and proceeded to test the resiliency of the cancer cells. Dr. Ling discovered that some cells rejected the drugs because of P-glycoprotein. Today, his research focuses on chemotherapy resistance. Dr. Ling's discovery of P-glycoprotein has both revolutionized cancer therapy and inspired other researchers to build on his work. Susan P.C. Cole, a renowned cancer scientist from Queen's University, is one of his unabashed fans. Dr. Ling appreciates the respect, but emphasizes that breakthroughs don't just happen. "You always have to build on your predecessors," he stresses.

As a 10-year-old boy, Hyman Niznik received a special issue of *Life* magazine that focused on the human brain. "It was at that point that I realized this is where it's at," says Dr. Niznik.

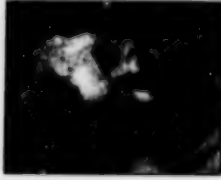
Today, Dr. Niznik is an associate professor in Psychiatry at the University of Toronto and a Principal Investigator at the Centre for Addiction and Mental Health. His primary

interest is unlocking the mysteries of mental illness, particularly schizophrenia. Since 1986, under the guidance of his mentor, Dr. Philip Seeman from U of T, Dr. Niznik has been attempting to understand the role of excess dopamine in schizophrenia. Dopamine is a natural chemical protein produced by the brain, which, in combination with GABA proteins (which regulate learning, memory, and emotion), produces erratic "communication" behaviour in people with schizophrenia. For years, drug treatments have interrupted the communication between dopamine receptors (called neurotransmitters) and GABA proteins. Along with his research team at U of T, Dr. Niznik has successfully cloned dopamine receptors from both schizophrenic brain tissue and normal brain tissue to better understand dopamine receptors' genetic makeup. His ultimate goal is to develop a cure for schizophrenia.



Recently, Dr. Niznik made a major discovery — that dopamine doesn't interact with GABA proteins. Nonetheless, his research into the genetic structure of dopamine receptors has enabled Dr. Niznik to better understand its nature. "We need to know the basic biology of the gene," he argues. This, he says, will lead to the creation of novel treatments to fight schizophrenia, creating a better life for the one in one hundred people and their families who suffer from schizophrenia.

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He was in the right place at the right time. In 1979, **Francis Plummer** was a young researcher specializing in infectious diseases, just three years out of medical school at the University of Manitoba, when he was offered the opportunity to go to Nairobi, Kenya. "I took it for the travel experience," Dr. Plummer says, "and the adventure." Initially, Dr. Plummer's research interests lay in gonorrhea. But as AIDS began to claim thousands of Kenyan lives, he turned his attention to HIV. In 1984, Dr. Plummer returned to Canada and was offered both a job at the U of M and the opportunity to go back to Kenya permanently. By then, he had fallen in love with

the country and had grown to care about its people. He accepted the offer, and since then he's been trying to unlock the mysteries of HIV on behalf of the university. Using a case study of about 100 prostitutes in Nairobi, Dr. Plummer has discovered that some people can be immune to HIV. He wants to understand two things: how these people are protected from the virus, and why they're so special. The results of Dr. Plummer's groundbreaking research could possibly lead to an AIDS vaccine. He has found that T-cells, which exist in every human's bloodstream, in the blood of HIV-resistant prostitutes have certain mechanisms that kill HIV. Dr. Plummer has also found out that HIV resistance could be genetically determined, so some people might be born resistant to the virus. "You take what life presents you," he says, "and you run with it."



• As a boy, **Judes Poirier** wanted to shoot for the stars as an astronaut. Today, instead of making it to the moon, Dr. Poirier has made his mark on Earth. In 1993, at age 32, he discovered that



apolipoprotein E, a protein that transports cholesterol to the brain, is also genetically linked to common Alzheimer's disease. Apo E, as it's known in scientific circles, exists in three forms in the human body (Apo E2, 3, and 4). Dr.

Poirier discovered that 80 per cent of patients who suffer from sporadic Alzheimer's, the most common form of the disease, have low levels of Apo E4. He also found out that Apo E4 partially controls the brain's communication

network — and might regenerate some of the broken pieces destroyed by Alzheimer's. Dr. Poirier's discovery made the front page of *The Wall Street Journal*, and *Québec Science* proclaimed him Neuroscientist of the Year — a remarkable achievement for someone who managed only moderate grades in high school. Today, Dr. Poirier is a director and professor at the Centre for Studies in Aging, a full professor in the Department of Psychiatry, and an associate member in the Department of Medicine and Department of Neurology and Neurosurgery, all at McGill University. He believes that developing an Apo E-based regeneration treatment could help people in their 70s and 80s, the age group where sporadic Alzheimer's develops,

live out their lives in a semi-natural way. "If we delay the disease by five years," Dr. Poirier points out, "we will eliminate half the cases." Working with Nova Molecular Inc., a biogenomic pharmacogenomic firm that he founded in 1995, Dr. Poirier tests new drugs that could raise levels of Apo E in Alzheimer's patients. Achieving this goal would mean this would-be astronaut could meet his aspirations on Earth.

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She describes herself as a small-town doctor with a good sense of community values. But **Christiane Poulin**, an associate professor in the department of epidemiology and community medicine at Dalhousie University, reaches far beyond the boundaries of a small town. As an epidemiologist, Dr. Poulin's research focusses on health at the community rather than the individual level. "I've always gravitated to issues of social inequity," Dr. Poulin says. Currently, she is receiving funding from MRC to study substance abuse among youths. The three-year study, which ends in 2001, involves four Nova Scotia schools and 2,000 students. Dr. Poulin wants to reduce involvement of harmful drugs in youths by reorienting drug education to focus on teaching young people about drug risks so that they can avoid substance abuse and determine their own futures. In



1982, Dr. Poulin graduated from l'Université Laval as a medical doctor. But she quickly found that, as a practitioner, she couldn't stop teenagers from abusing drugs. So Dr. Poulin went back to school and graduated from McGill University in 1990 with a master's degree in epidemiology. Today, she addresses drug addiction at its source and also investigates the abuse of ritalin among children. The motivation for Dr. Poulin's career change is simple. "It's difficult to fix addiction problems at the clinical level," she says.

- About 11 years ago, Arthur Prochazka had an idea for a glove — not just any glove, but a bionic one that would help people confined to



wheelchairs or those impaired by strokes. The bionic glove would revitalize human movement for those who could no longer move. Along with his research team at the University of Alberta, Dr. Prochazka

developed the bionic glove to artificially stimulate nerve activity in the hands, so that paralysed people could open and close their hands. Starting in 1993, Dr. Prochazka spent three years constructing a prototype bionic glove.

his lab at U of A. Today, this form-fitting glove stimulates movement in a paralysed person's hand with electrodes affixed to 'motor points'. The electrodes are activated by a user-friendly stimulator/computer built into the garment. Small, voluntary movements of the wrist trigger muscle stimulation through the electrodes, which causes the hand to open or close. Clinical trials of the glove have been successful. "There are about 45 people in all who've been tested around the world," says Dr. Prochazka. The bionic glove has made appearances in Chicago, New York and Adelaide, Australia. Dr. Prochazka, a professor of physiology at U of A, is currently working on the "impact cuff", an electronic garment triggered by jarring that is used by stroke victims to retrain their paralyzed hands.

Yet another such garment reduces tremor in people with Parkinson's disease," Dr. Prochazka explains. He's also working on spinal cord regeneration through microwires. This novel research, developed with post-doctoral student Jian Mushahwar, involves the implantation of wires directly into the spinal cord to stimulate movement. Dr. Prochazka's work holds out hope that Canadians with disabilities may some day be able to regain what they've lost.



- As a pediatrician, Marek Rola-Pleszczynski found himself

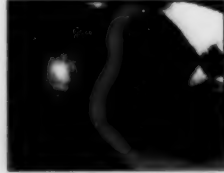


up against a medical brick wall. "There were so many questions that patients asked," he says, "and I had no answers." So Dr. Rola-Pleszczynski decided to pursue the answers himself. Today, he is a professor of Immunology and Pediatrics, head of Immunology in the Département of

Pediatrics, and director of the Clinical Research Centre and University Health Sciences Centre at l'Université de Sherbrooke. Dr. Rola-Pleszczynski's research is primarily concerned with inflammatory mediator receptors. These receptors are large proteins that surround the surface of cell membranes. Dr. Rola-Pleszczynski uses the analogy of a baseball mitt. The mitt is the receptor, the catcher's arm would transmit the information to the inside of the cell itself. The receptors surrounding the mitt interact with the various particles or proteins that come in contact with them and incorporate their structures into the cell. This can have positive or negative consequences for the immune system. Dr. Rola-Pleszczynski wants to understand how these receptors work, in particular receptors for lipid mediators, platelet-activating factor (PAF) LTB₄ and LTD₄. These powerful protein mediators could help doctors better treat people suffering from pulmonary disorders,

neurological diseases, or inflammatory bowel problems. Over the past few months, Dr. Rola-Pleszczynski has been addressing the recently cloned LTD₄, a receptor that, when genetically decoded, could help people who suffer from asthma. Dr. Rola-Pleszczynski continues to work toward his goal of improving the human immune system — step by step. "It's the little developments that matter," he says.

- In the late 1970s, Peter St. George-Hyslop saw people



with Alzheimer's disease remain physically intact but lose their "human qualities" as their minds degenerated. Dr. St. George-Hyslop wanted to stop this loss. In 1995, along with his team of neurologists, geneticists and statisticians at the University of Toronto, Dr. St. George-Hyslop discovered

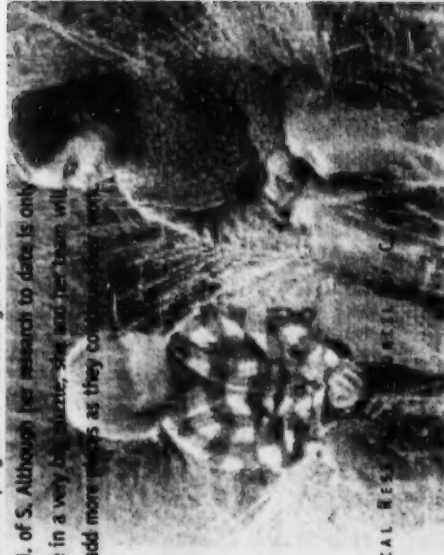
two human genes that cause the early onset of Alzheimer's disease. The genes were cloned and called presenilin 1 and 2. The discovery was an important step forward in the battle against Alzheimer's. Today, genetic testing can tell people if they will experience the early symptoms of Alzheimer's in their thirties or forties. Dr. St. George-Hyslop, who taught at Boston's Harvard University and won the Howard Hughes Foundation International Scholar Award, now wants to develop possible treatments for the

currently untreatable disease. "When you see the Alzheimer patients," Dr. St. George-Hyslop says, "and the torment (the disease) causes to people, their families and society, it's a strong impetus to keep going." His current research focuses on analyzing the genetic pathways of communication in the human brain. With the help of presenilin 1 and 2, Dr. St. George-Hyslop and his research team at U of T hope to understand how these pathways are obstructed by Alzheimer's. His research could someday help people who are losing their "human qualities" to stay whole.

- **Valerie Verge**, a McGill University graduate, first caught the research bug when she landed a job as a research technician in the laboratory of Dr. Peter Richardson, a neurosurgeon at the Montreal General Hospital who was her mentor during her doctoral studies. But it was while undertaking post-doctoral work under Professor Tomas Hökfelt at the Karolinska Institute, in Stockholm Sweden, that Dr. Verge met her future husband, a Saskatchewan farmer. That, combined with a job opportunity, brought her to Saskatchewan in 1992. Dr. Verge, now an associate professor in the Department of Anatomy and Cell Biology



at the University of Saskatchewan, is concerned with sensory neurons, or cells that affect people's sense of touch. Neurons transmit information from the brain to various nerves and muscles. Together with her research team, Dr. Verge is investigating how the molecular profiles of these neurons change in response to disease or injury, and how we can repair them. She has discovered that a group of proteins called neurotrophins can help reverse many of the changes in these neurons following injury. Though neurotrophins may some day help people with neuropathies such as those found in diabetes, Dr. Verge is careful to add that these proteins are not the entire answer. "There's a lot to be learned about the basic biology of nerve injury and repair, so that we can better predict their true potential," she says. Dr. Verge attributes a lot of her research progress to the strength of her lab team at the U. of S. Although her research to date is only the first piece in a very big puzzle, she and her team will undoubtedly add more pieces as they continue their work.



- Like most great scientists, **Martin Yaffe** started out with a



vision. A professor of medical biophysics at the University of Toronto and a senior scientist at Sunnybrook & Women's College Health Science Centre, Dr. Yaffe wanted to develop a machine that could detect breast tumours earlier, when treatment is more effective. In 1997, working with Don Plewes

and other scientists, he achieved his vision — digital mammography. This machine uses x-rays to photograph malignant breast tumours, but, instead of recording the picture on film, it is captured using a much more accurate electronic "detector" developed in Dr. Yaffe's lab. Digital mammography takes X-ray photography one step further, by storing the electronic image on a computer. For the patient, it is like having a regular mammogram, but images are recorded digitally and can be magnified and enhanced with the click of a computer mouse, providing a clearer image of the breast tissues. The result is that small tumours and other early signs of cancer can be found. Three companies in the United States and one in Japan are now building digital mammography systems and one system has recently been granted FDA approval for routine clinical use in the U.S. While Dr. Yaffe believes that an important benefit of the technology comes from the

quality of the pictures, the fact the images are in digital form will make it possible to send digital images from mobile machines in remote areas to expert radiologists in larger centres who can read the mammograms. Evidence of the effectiveness of digital mammography is now being seen in clinical trials begun in 1997. One of the exciting things about the work I do, says Dr. Yaffe, "is that it involves a combination of science, engineering, and clinical testing, and lets me work with experts in all of these areas."

- He never wanted to be a researcher. But in the late 1970s,



Salim Yusuf, then an intern in a remote Indian village 100 kilometres from Bangalore, wondered why half the patients he saw each day were suffering from gastrointestinal disease. Using a rock, a long string, and a bucket, he drew water from the village's wells and sent the samples to a nearby laboratory

for bacterial analysis. Dr. Yusuf then rode around the village on a bicycle and bleached the wells. A subsequent test showed that bacteria levels in the village water had dropped by about 80 per cent. Dr. Yusuf had answered his own research question and had a powerful impact on the villagers' health. This drive for knowledge led Dr. Yusuf to

a Rhodes scholarship at Oxford University, where he graduated with a D.Phil. in 1981. Since then, Dr. Yusuf's list of interests and accomplishments is impressive. His research areas include thrombolysis (the breaking down of blood clots), antithrombotics, prevention of vascular diseases, and congestive heart failure. In 1999, Dr. Yusuf discovered that a drug called ramipril reduces the risk of heart attacks by 25 per cent in high-risk patients. And this, it seems, is only the beginning for the doctor, who sees himself at being only halfway through his career. His research efforts have now extended to 55 countries, more than half of them developing countries. Dr. Yusuf says his greatest rewards come from passing on his zest for knowledge to his students at Hamilton's McMaster University, where he is director of the Division of Cardiology and professor of Medicine. "I've been fortunate to attract people who have the burning desire to change the world," he says. "It's trying to help the young people choose the big questions, and help them go after the answers." He sees in some of his students a memory of himself: a doctor who answered his driving research question with the help of a string, a rock and a bicycle.

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Chapter 6: CIHR — The Way Ahead

TODAY, WE STAND ON THE VERGE OF A NEW ERA IN HEALTH RESEARCH IN CANADA — AN ERA OF UNPRECEDENTED INVESTMENT IN HEALTH RESEARCH, AND AN ERA OF UNPARALLELED INTEGRATION OF DIFFERING PERSPECTIVES ON HEALTH RESEARCH. WE ARE EMBARKING UPON THE ERA OF THE CANADIAN INSTITUTES OF HEALTH RESEARCH (CIHR). THE RESULT WILL BE BETTER HEALTH FOR CANADIANS, A BETTER HEALTH CARE SYSTEM, AND INCREASED ECONOMIC GROWTH FOR CANADA.

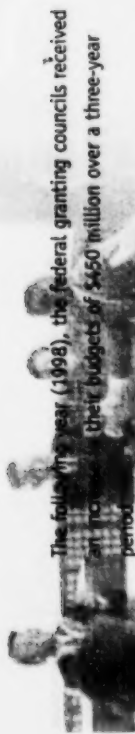
"CIHR is a bold initiative. It has the power of a dream, of a vision. It is breathtaking in its inclusivity, in its national dimensions."

Dr. Henry Friesen
President, MRC
Chair, Interim Governing Council, CIHR

The CIHR arises from a challenge posed by Prime Minister Jean Chrétien to the research community — a challenge to aspire to be in the top tier of G7 countries in our areas of strength; a challenge to not be satisfied simply with increased funding, but to go beyond, to envision a new system of health research to carry Canada into the 21st century.

The health research community responded with a unanimity of voice and a concentration of efforts, through the National Task Force on Health Research. It was this task force that created the CIHR vision, but it was all members of the health research community who convinced the Government of Canada that investing in this vision was the right thing to do, and that the investment would pay large dividends to the people of Canada.

CIHR is yet another example of the federal government's commitment to excellence in research. It builds on past budget measures, including the creation of the Canada Foundation for Innovation in 1997. This first step in renewing the research environment in Canada provides financial support for the modernization of research infrastructure at Canadian post-secondary educational institutions and research hospitals.



The following year (1998), the federal granting councils received an increase in their budgets of \$450 million over a three-year period.

CJHR is also complemented by the creation of the Canada Research Chairs. This new initiative will fund the creation of 1,200 new research chairs in Canadian universities over the next three years, with a further 800 chairs to be added as soon as possible. Fully a third of these chairs, or close to 700, are expected to be in health research. The program will be financed by the federal government through its granting councils, including the CIHR. Research chairs will be directed toward "star" researchers with proven track records of leading research endeavours, as well as to the "rising stars" of tomorrow.

"The federal government must be commended for putting forward a vision of an integrated health research enterprise that will benefit all Canadians. There is no better investment than in health research, where the health care dollar can be used more wisely, and where jobs can be created."

Dr. Mark Fozzansky
Council for Health Research in Canada

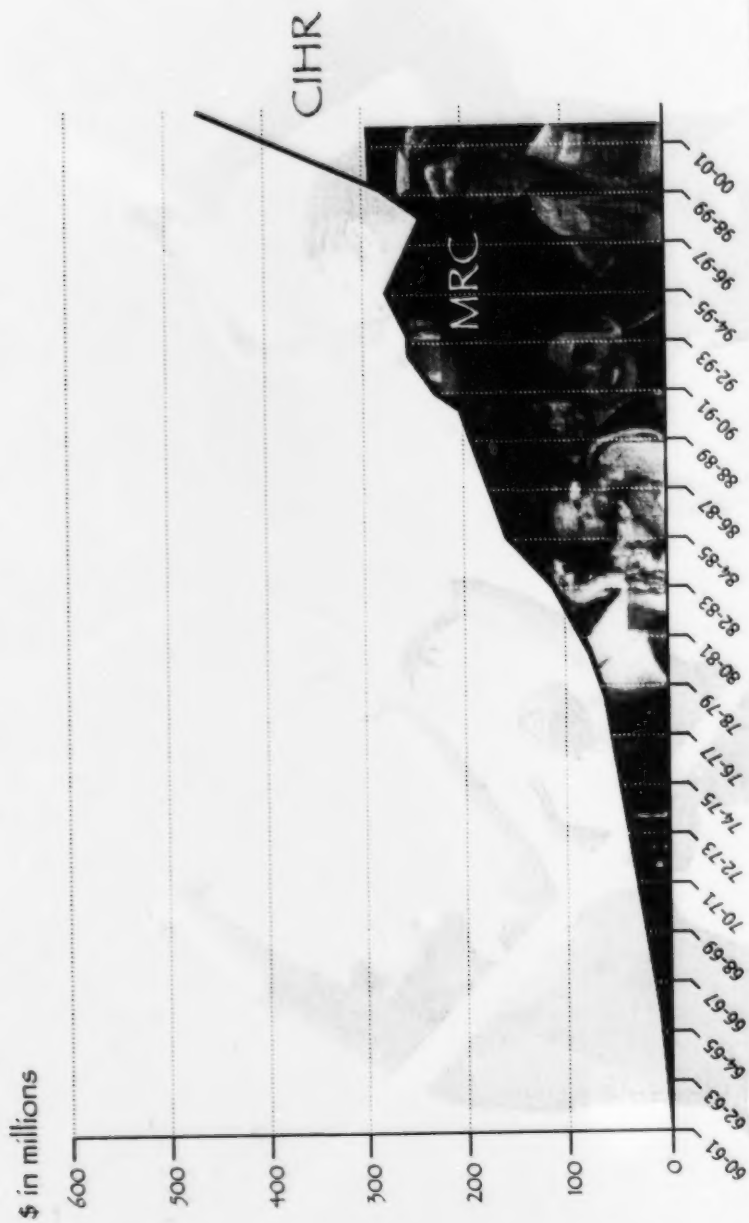
The creation of CIHR underscores the federal government's understanding of the important role of health research in improving the health and well-being of Canadians, renewing the Canadian health care system, stimulating innovation, and training of future generations. It is a natural step forward in the evolution of Canada's health research enterprise.

"The 1999 budget may well be best remembered above all for the investment we made in modernizing Canada's health research enterprise."

Prime Minister Jean Chrétien

CIHR doubles the federal government investment in health research. But more than that, it represents a new approach to health research in Canada. For the first time, Canada will have a focused national health research agenda, established and supported by the federal government, in partnership with the health research community, provincial governments, the voluntary health charities, and the private sector, and responding to the health priorities of Canadians. CIHR will increase the depth, breadth, focus, utility, and interconnectedness of Canadian health research.

MRC - CIHR Budget: a 40-year history



"The objective of CIHR is to excel, according to internationally accepted standards of excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products, and a strengthened Canadian health care system."

Bill C-15, An Act to establish the Canadian Institutes of Health Research

Canada: The place to be for excellent researchers

CIHR will have an immediate impact on the careers of Canadian scientists, creating a brain gain where once there was a brain drain. In the past few years, some of Canada's top health researchers had left for other countries, citing insufficient funding, declining success rates in MRC competitions, lack of opportunity for advancement for mid-career researchers and lack of research positions for post-doctoral students to start their careers. Since CIHR was announced, however, health researchers have been expressing new interest in Canada.

Over the past year, universities, hospitals, and research institutes have been able to attract top researchers, both those returning to Canada and those new to Canada:

- **David Park** has joined the Neuroscience Research Institute at the University of Ottawa, from Columbia University, where he held a post-doctoral fellowship.
- **Richard Frayne** has returned to the University of Calgary after a five-year absence in the United States.

"If we set the right objectives, if we make the right investments, if we create the right partnerships, and if we work together as a country, not only will we keep the best and the brightest in Canada, we will attract the best and the brightest from around the world to Canada."

Prime Minister Jean Chrétien,

Response to the Speech from the Throne,
October 1999

- **Pierre von der Weid** has joined the Inflammation Research Group at the University of Calgary. A Swiss citizen, Dr. von der Weid was recruited from the University of Geneva.
- **Geoff Hicks** moved from Vanderbilt University in the United States to take up a position as an assistant professor in the Department of Biochemistry and Medical Genetics and a research associate in the Manitoba Institute of Cell Biology. Dr. Hicks has received a large MRC operating grant under the Genomics Initiative, as well as a New Opportunities Award from the Canada Foundation for Innovation.
- **Shelley** University has recruited **Guylain Boulay** from Portland, Oregon, and **Patrick McDonald**, an MRC Clinical Fellow, from Denver, Colorado.
- **Sandra** a researcher in infectious diseases, is now at Université Laval, where she is supported in her research by MRC. Dr. Sato received her doctoral degree from the University of Tokyo, and had been a post-doctoral researcher at Stanford University in the United States.
- **Eric Brown**, a young Canadian researcher, had been working as a research scientist at the ASTRA Research Center in Cambridge, Massachusetts. He has since

- returned to Canada as an assistant professor in the Department of Biochemistry at McMaster University.
- **Yingfu Li**, also a Canadian, has returned from post-doctoral work at Yale University to also become an assistant professor in the Department of Biochemistry at McMaster.
- **Jun Liu** was recruited to the University of Toronto from the Department of Molecular and Cell Biology at the University of California at Berkeley. He is currently studying drug resistance mechanisms in tuberculosis.
- **Scott Gray-Owen** was also recruited to the University of Toronto, this time from the Max Planck Institut für Biologie in Tübingen, Germany.

This new approach will bring together researchers from a variety of perspectives and with a variety of points of view to encourage multidisciplinary, integrative health research. Basic biomedical research will co-exist with applied clinical research, research into health systems and services, and population health research within thematic institutes that will take a holistic approach to health.

A LEGACY OF EXCELLENCE

THE MEDICAL RESEARCH COUNCIL OF CANADA



Throughout this transformation from MRC to CIHR, the high standards that have been the hallmark of MRC, including its world-renowned peer review process and its exemplary commitment to ethics in research, will live on in CIHR.

CIHR opens a new world for health researchers, for Canadians, and for the Canadian economy.

For health researchers, CIHR will provide the long-term commitment to support research initiatives that will leave them secure in the knowledge that they can have successful careers, with internationally competitive levels of funding, at home in Canada. Instead of brain drain, we will see a brain gain, as we build on our proud tradition of research excellence.

For Canadians, CIHR will mean the creation of knowledge that will help to prevent and treat diseases. It will mean faster development of new treatments and therapies and more efficient and cost-effective delivery of these treatments and other health services through a health care system that responds to their needs and priorities.

For the Canadian economy, CIHR will support the fast-growing life sciences sector in Canada, creating high-quality jobs for Canadians while enhancing Canada's competitiveness in the knowledge-based economy.

Canadian Institutes of Health Research are all about
to encourage those who seek it, and to
who achieve it."

Health Minister Allan Rock
University of Toronto
October 22, 1999

If, as the House of Commons Standing Committee on Finance has observed, the federal granting councils are the key to Canadian leadership in the knowledge-based economy of the 21st century, then CIHR is an important step in consolidating Canada's leadership role. CIHR will allow Canada to maintain and strengthen its prominent position in the top tier of health research internationally.

The creation of the Canadian Institutes for Health Research will mean the end of the existence of the Medical Research Council of Canada. But it does not spell the end of what MRC has represented

over the past 40 years. Indeed, it is a preservation of the expansion of the legacy of the MRC, transforming MRC into a new system of health research.



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